



Performance of Dyalog APL – A Historical Perspective

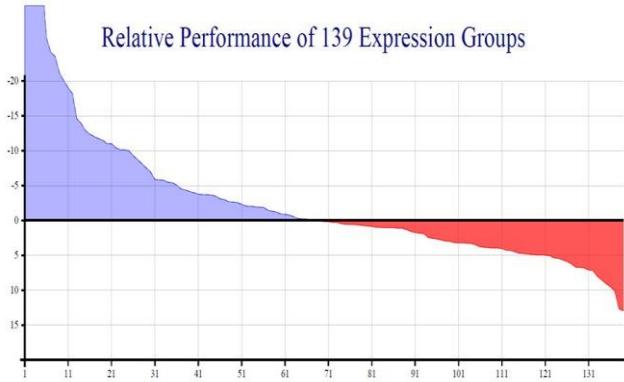
Veli-Matti Jantunen
Statistics Finland/Technology Services

Me, myself and I

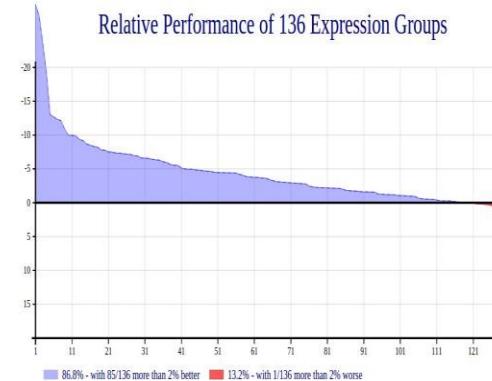
- Known APL since 1980
 - APL\3000, VSAPL, APL*PLUS, **APL2**, APL2/PC, DyalogAPL...
- Last 20+ years spent programming this one application (*PxEdit*) which is being used in statistical offices etc. all around the globe
 - **fully** programmed with DyalogAPL
 - handles text files
 - ±0.01 seconds per file read/write & database with 7200 files
→ ±1.2 minutes total processing time...
- BTW: **OML←3**

Dyalog landscape

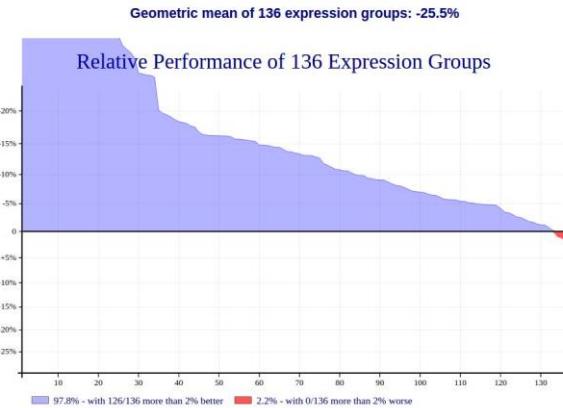
Performance Comparison
Between Windows-64 14.0.22478.0 and Windows-64 13.2.21909.0



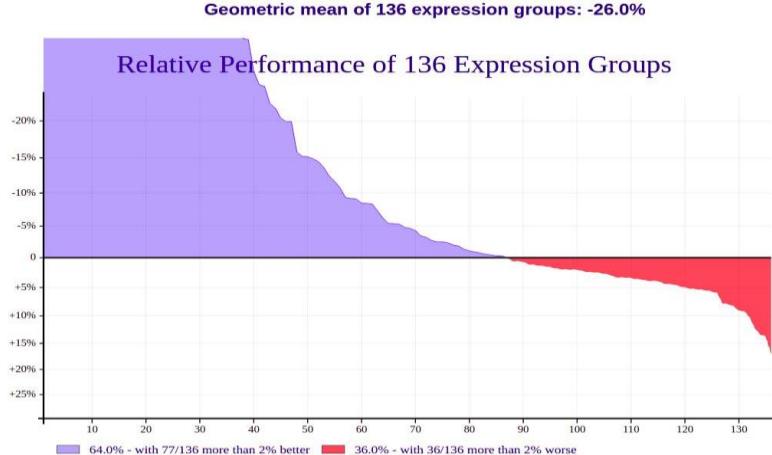
Performance Comparison
Between Windows-64 14.1.24671.0 and Windows-64 14.0.21929.0



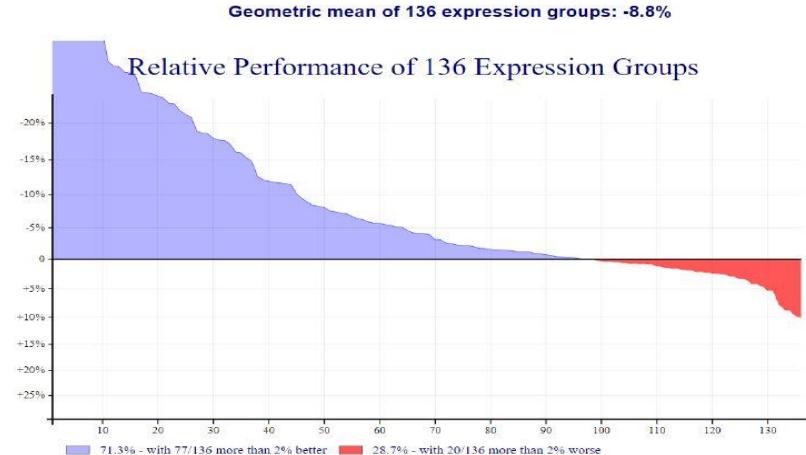
Performance Comparison
Between Windows-64 15.0.27176.0 W Development and Windows-64 14.1.25052.0 W Development



Performance Comparison
Between Windows-64 17.0.33755.0 W Development and Windows-64 16.0.30270.0 W Development



Performance Comparison
Between Windows-64 18.0.36852.0 W Development and Windows-64 17.1.36845.0 W Development



Introducing the new version

- Dyalog tests **all** features
 - most of which I don't use...
 - what about if something crucial (for me) is always on the red side?
 - **□VFI**, **□FMT**, **□MAP**
- The performance order between idioms and/or primitives may change
 - e.g. previously there was a remarkable difference $\{u\omega\}$ vs. $\{((\omega \imath \omega) = \imath \rho \omega) / \omega\}$

Testing package

```
tst_bin_any; bv; ls
└─'Eikö yksikään binäärivektorin alkio ole 1?'
bv<-dat.bin_any

ls<-
ls,<-c '{^/~ω}`"bv'
ls,<-c '{~v/ω}`"bv'
ls,<-c '{0=Γ/ω}`"bv'
ls,<-c '{~1∈ω}`"bv'

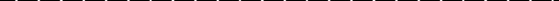
Δcmpx ls
```

Testing version 18.2

18.0 / 64

```
vec<-999ρ<'abc' ◊ vec[998]←c'xyz'  
]runtime -c {~0∈ω≡`1ρω}vec {ω^..≡ω[1]}vec
```

18.2 / 64

```
{~0<ω≡``1ρω}vec → 2.9E-6 | 0%  
{ω^..≡ω[1]}vec → 2.4E-4 | +8087% 
```

18.0 / 64

```
mat<-100 10(?ρ)0  
]runtime -c {¬/ω}mat (↑ö1)mat
```

18.2 / 64

How to compare different Dyalog versions?

- Install *all* interpreters (28) in the same laptop
 - Win7 (HP2650p)
 - 8.1/Classic – 18.2/Unicode (32/64-bit)
- Run the test package (64) in every interpreter
 - **same** code in all versions, even in Classic ones
 - try to minimise the background noise
 - no internet
 - no screen saver



Something like this

- Open an interpreter
 - import the test package from a **common** code file
 - run the test package (~20 min)
- Every test result will be saved in a corresponding `csv` file
- When the tests are done, the `csv` files will be converted to `px` files using a separate template file containing the appropriate metadata
- The results can then be examined in PxEdit...

Backwards compatibility

- The basic package is created using version 18
- DyalogAPL has developed a lot since e.g. version 11
 - 11.0: ⚫, □, 64-bit
 - 12.0: Unicode, □UCS
 - 12.1: □I, □,
 - 13.0: ⌈, ⌉, ⌈, □B, 2000□I, □R
 - 14.0: ≠, □目, □ö, (f g h)
 - 15.0: □NPARTS, ...
 - 16.0: ≤, □l, @, □⊗
 - 17.0: TAO: { (<△ω) □ω }
 - 18.0: ≠, □ö, □z, □c
- Converting to classic
 - saved as □VR coded codepoints in a text file
 - read using □AVU, all untranslatable glyphs → question marks

Testing package revisited

```
tst_bin_any;bv;de;fe;pe;_fun;_txt

_fun<-'bin-any'
_txt<-c'Eikö yksikään binääriivektorin alkio ole 1?'
_txt<-c'Isn''t any value of the binary vector 1?'

bv<-dat.bin_any ◊ de<-fe<-pe<'

de,<-c '^/0=ω'          A d-functions
de,<-c '^/~ω'
de,<-c '¬v/ω'
de,<-c '0=Γ/ω'
de,<-c '¬1∈ω'

fe,<-14 Δver'¬1∈Γ'      A function trains
fe,<-14 Δver'≠<ι○1'

pe,<-c '¬v/'           A primitives
pe,<-c '¬1∈'

...'"bv'Δrun de fe pe
```

Structural csv file

0	1	2	3
bin-any	fi		
Idiomit	Idiomit	Versiot	
b/0=w	b/0=w	8.1-32	1200
b/~w	b/~w	8.1-32	670
~v/w	~v/w	8.1-32	660
0=M/w	0=M/w	8.1-32	660
~1ew	~1ew	8.1-32	460
~v/	~v/	8.1-32	410
~1e	~1e	8.1-32	360
b/0=w	b/0=w	8.2-32	1300
b/~w	b/~w	8.2-32	670
~v/w	~v/w	8.2-32	670
0=M/w	0=M/w	8.2-32	670
~1ew	~1ew	8.2-32	490
~v/	~v/	8.2-32	440
~1e	~1e	8.2-32	360
b/0=w	b/0=w	10.0-32	940
b/~w	b/~w	10.0-32	500
~v/w	~v/w	10.0-32	450
0=M/w	0=M/w	10.0-32	450
~1ew	~1ew	10.0-32	460
~v/	~v/	10.0-32	290
~1e	~1e	10.0-32	350
b/0=w	b/0=w	10.1-32	690

Tab-separated template file

PX file

E bin-any.px

```
CHARSET="ANSI";
AXIS-VERSION="2010";
CODEPAGE="utf-8";
LANGUAGE="fi";
LANGUAGES="fi","en";
DECIMALS=0;
DESCRIPTION="Eikö yksikään binäärivektorin alkio ole 1?";
DESCRIPTION[en]="Isn't any value of the binary vector 1?";
TITLE="Eikö yksikään binäärivektorin alkio ole 1?";
TITLE[en]="Isn't any value of the binary vector 1?";
DESCRIPTIONDEFAULT=YES;
CONTENTS="bin-any";
CONTENTS[en]="bin-any";
STUB="Idiomit";
STUB[en]="Idioms";
HEADING="Versiot";
HEADING[en]="Versions";
VALUES("Idiomit")="{}~bv", "1~bv", "~~~bv", "~~~bv", "0=~bv", "(~1)~bv",
"~1~bv", "~1~bv", "~~~bv";
VALUES[en]("Idioms")="{}~bv", "1~bv", "~~~bv", "~~~bv", "0=~bv", "(~1)~bv",
"~1~bv", "~1~bv", "~~~bv";
VALUES("Versiot")="18.2-32", "18.0-32", "17.1-32", "17.0-32", "16.0-32", "15.0-32", "14.1-32", "14.0-32",
"13.2-32", "13.1-32", "13.0-32", "12.1-32", "12.0-32", "11.0-32", "10.1-32", "10.0-32", "8.2-32", "8.1-32";
VALUES[en]("Versions")="18.2-32", "18.0-32", "17.1-32", "17.0-32", "16.0-32", "15.0-32", "14.1-32",
"14.0-32", "13.2-32", "13.1-32", "13.0-32", "12.1-32", "12.0-32", "11.0-32", "10.1-32", "10.0-32", "8.2-32",
"8.1-32";
CODES("Idiomit")="b/0=w", "~1eJ", "b/~w", "~v/w", "0=M/w", "Q<io1", "~1ew", "~1e", "~v/";
CODES[en]("Idioms")="b/0=w", "~1eJ", "b/~w", "~v/w", "0=M/w", "Q<io1", "~1ew", "~1e", "~v/";
DATA=
440 380 430 480 660 650 750 750 770 780 760 750 750 690 940 1300 1200
400 450 330 340 290 320 560 570 ..." ..." ..." ..." ..." ..." ..." ..." ..." ...
380 350 400 430 410 420 450 530 480 470 490 480 460 430 390 500 670 670
340 310 330 340 360 380 410 410 420 450 440 430 390 380 450 670 660
310 300 300 370 360 370 520 430 440 450 440 420 410 390 360 450 670 660
270 240 360 350 340 350 410 410 ..." ..." ..." ..." ..." ..." ..." ..." ...
220 360 210 210 160 180 410 390 450 450 450 450 430 420 380 460 490 460
110 250 130 110 71 100 320 320 340 330 330 340 330 300 270 350 360 360
17 17 17 16 20 21 250 250 270 270 260 260 240 240 210 290 440 410;
```

PX table in PxEdit...

E [1] Isn't any value of the binary vector 1?

File Edit Window Language

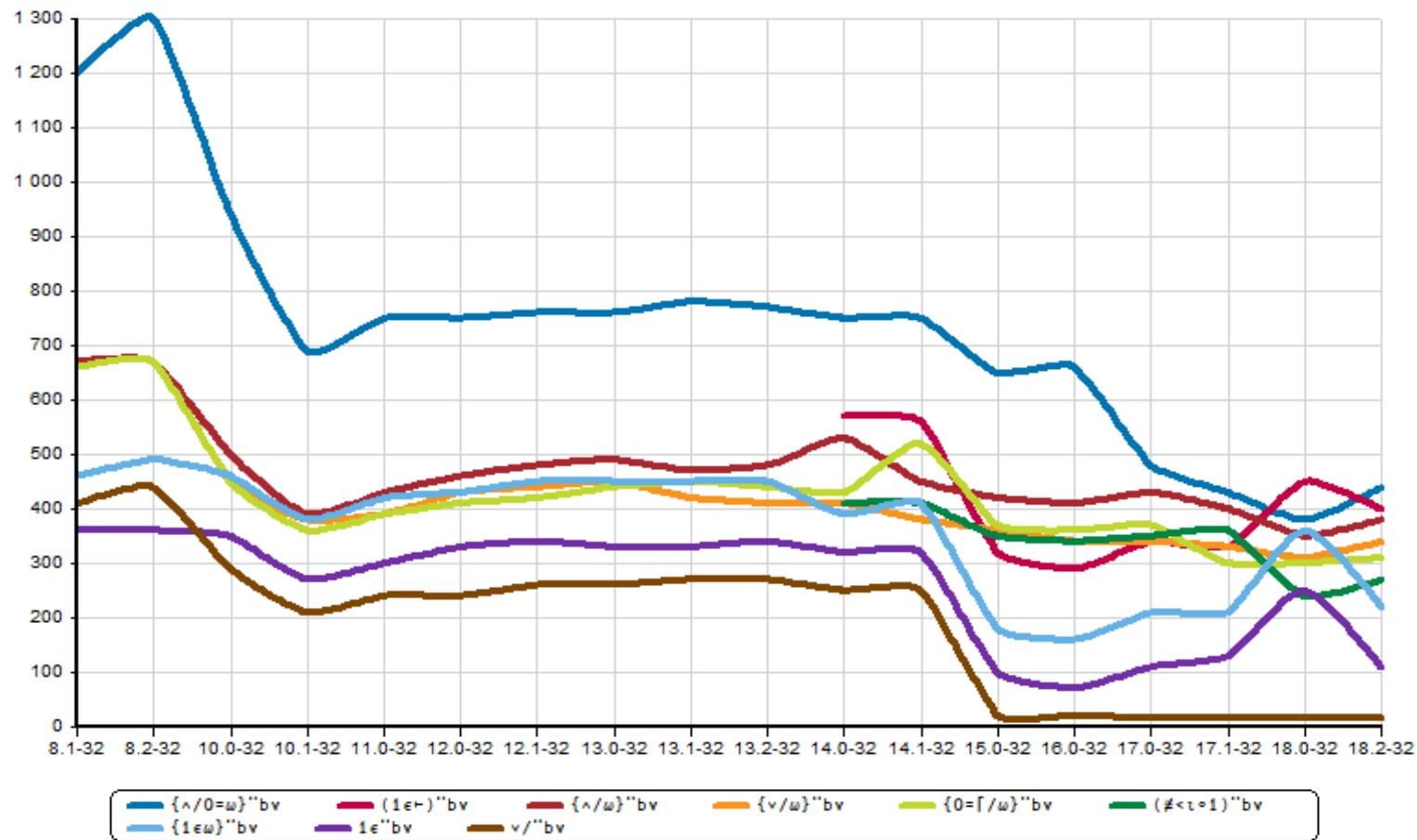
	18.2-32	18.0-32	17.1-32	17.0-32	16.0-32	15.0-32	14.1-32	14.0-32	13.2-32	13.1-32	13.0-32	12.1-32	12.0-32	11.0-32	10.1-32	10.0-32	8.2-32	8.1-32
{ $\wedge/0=\omega$ }~bv	440	380	430	480	660	650	750	750	770	780	760	760	750	750	690	940	1300	1200
($\sim 1 \in \vdash$)~bv	400	450	330	340	290	320	560	570	..	..	..	..	..	..	..	..	..	..
{ $\wedge/\sim\omega$ }~bv	380	350	400	430	410	420	450	530	480	470	490	480	460	430	390	500	670	670
{ $\sim\vee/\omega$ }~bv	340	310	330	340	340	360	380	410	410	420	450	440	430	390	380	450	670	660
{ $0=\Gamma/\omega$ }~bv	310	300	300	370	360	370	520	430	440	450	440	420	410	390	360	450	670	660
($\#\leq l=1$)~bv	270	240	360	350	340	350	410	410	..	..	..	..	..	..	..	..	..	..
{ $\sim 1 \in \omega$ }~bv	220	360	210	210	160	180	410	390	450	450	450	450	430	420	380	460	490	460
$\sim 1 \in$ ~bv	110	250	130	110	71	100	320	320	340	330	330	340	330	300	270	350	360	360
$\sim\vee/\Gamma$ ~bv	17	17	17	16	20	21	250	250	270	270	260	260	240	240	210	290	440	410

< > en

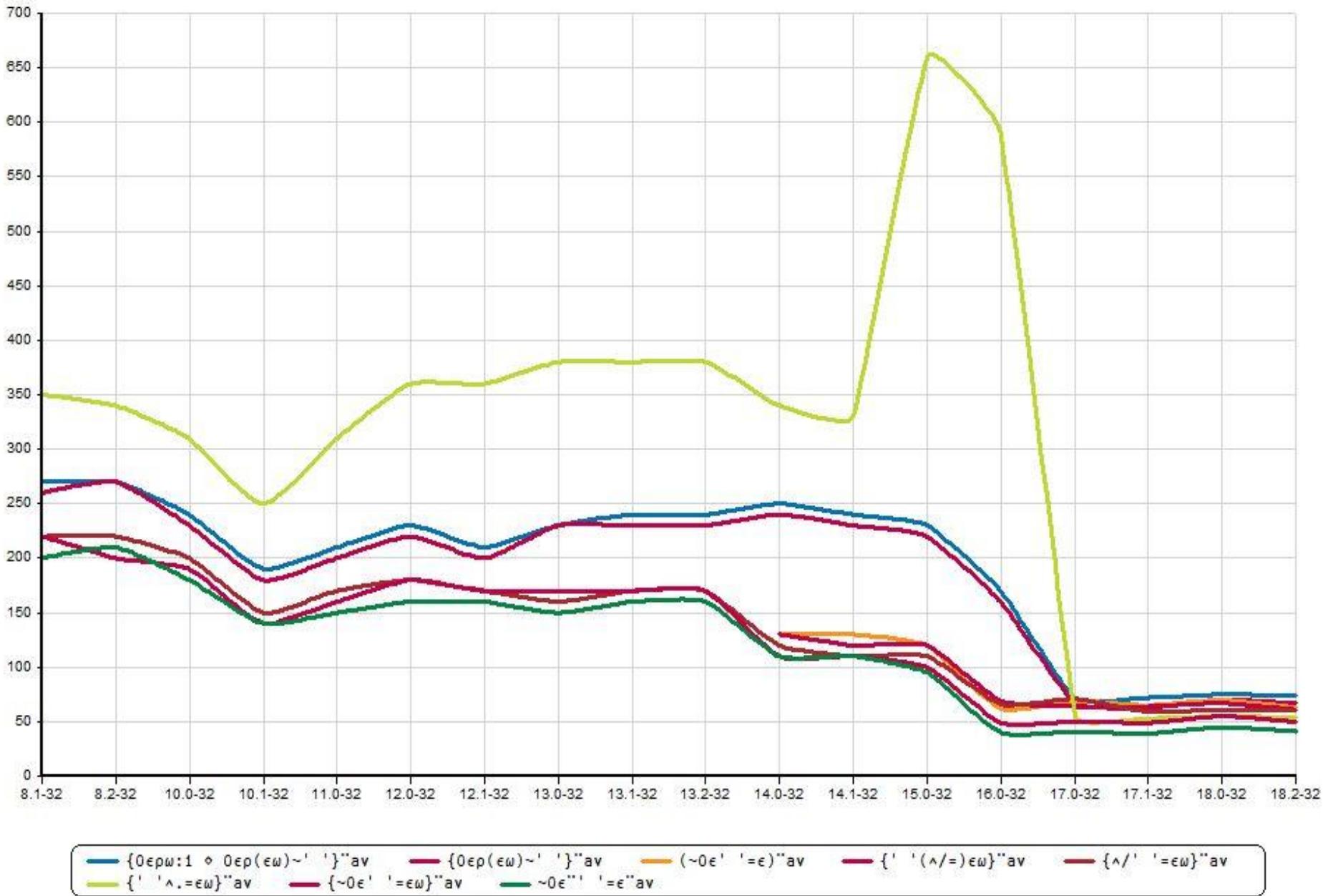
9 rows x 18 columns = 162 figures

...and in *RainPro*

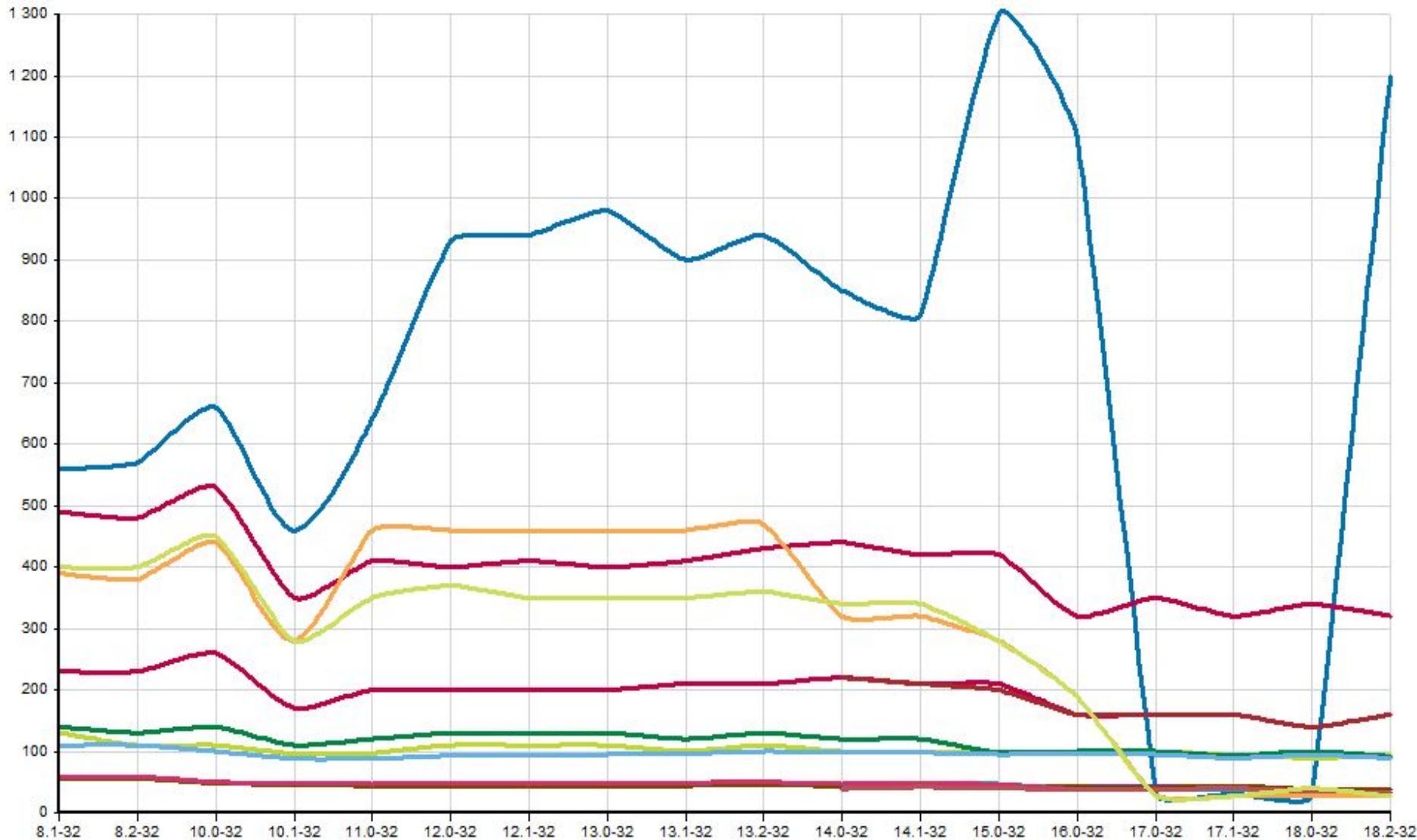
Isn't any value of the binary vector 1?



Empty or all-blank argument?

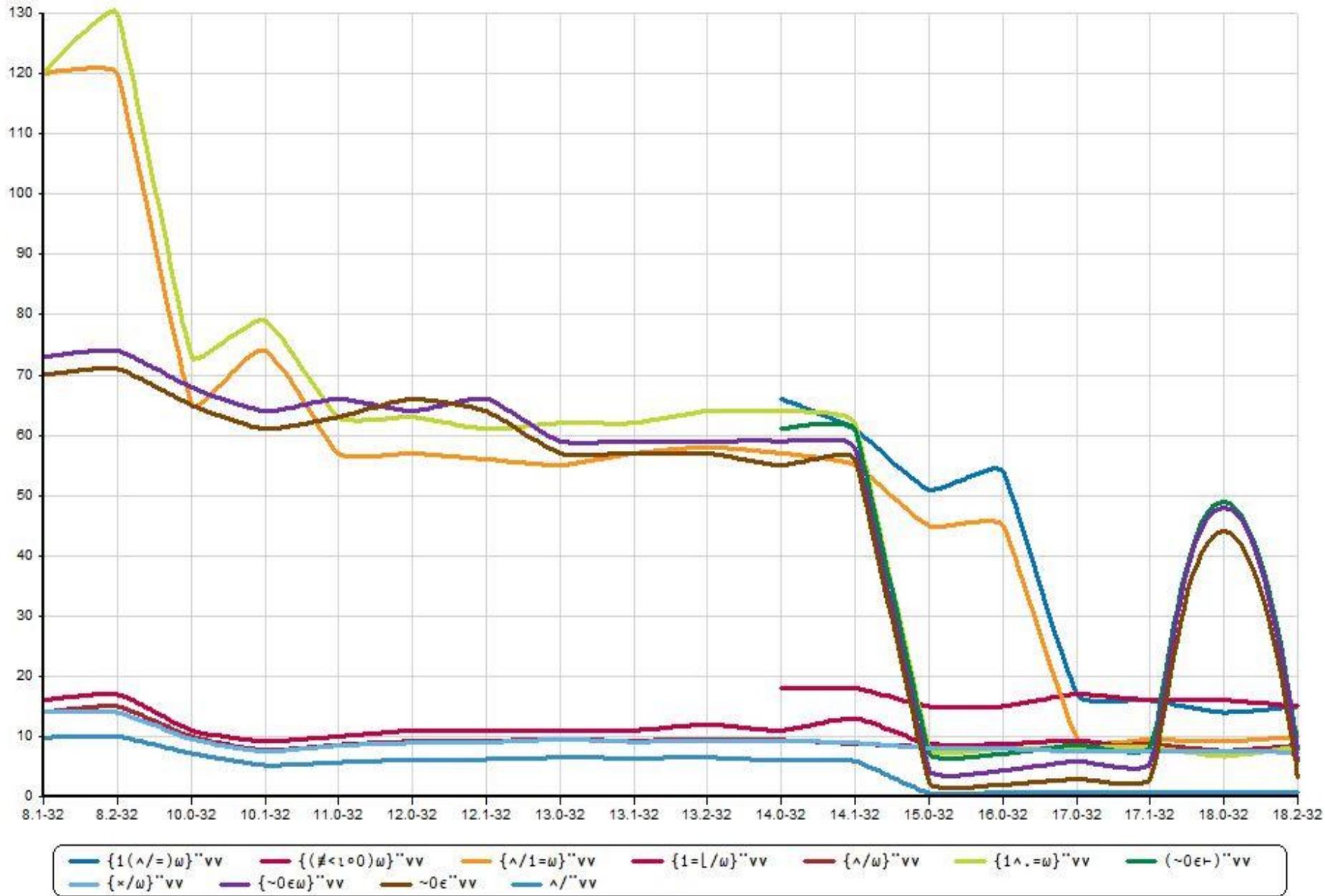


Are all items in a nested vector equal?

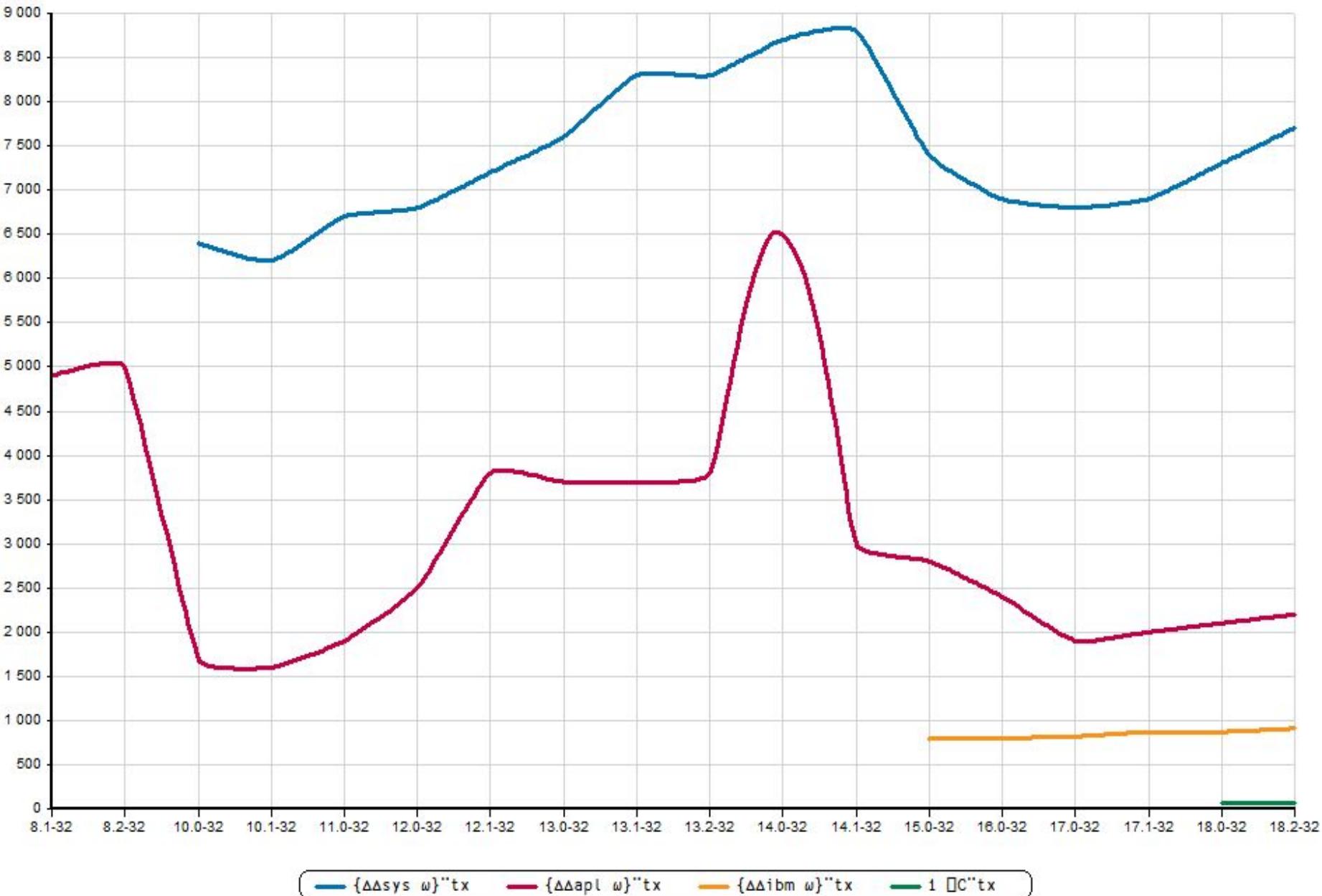


- $\{w \wedge . = w[1]\} \Rightarrow v$ $\{1 = \lceil w \rfloor w\} \Rightarrow v$ $\{1 \neq \#w\} \Rightarrow v$ $\{1 = \#p \# w\} \Rightarrow v$ $1 \neq \#v \Rightarrow v$ $\{\wedge \# w \in w[1]\} \Rightarrow v$
 $\{\sim 0 \in w \in w[1]\} \Rightarrow v$ $\{0 \in p \# w \in w[1]\} \Rightarrow v$ $(1 \circ \phi \circ \vdash) \Rightarrow v$ $\{w \in 1 \# \omega\} \Rightarrow v$ $\{w \in (\# \omega) p \in \# w\} \Rightarrow v$ $\{w \in (\rho \omega) \rho w \in w[1]\} \Rightarrow v$
 $\{w \in (\# \omega) / c \in w\} \Rightarrow v$ $\{\wedge / w \in w[1]\} \Rightarrow v$ $\{\sim 0 \in w \in w[1]\} \Rightarrow v$

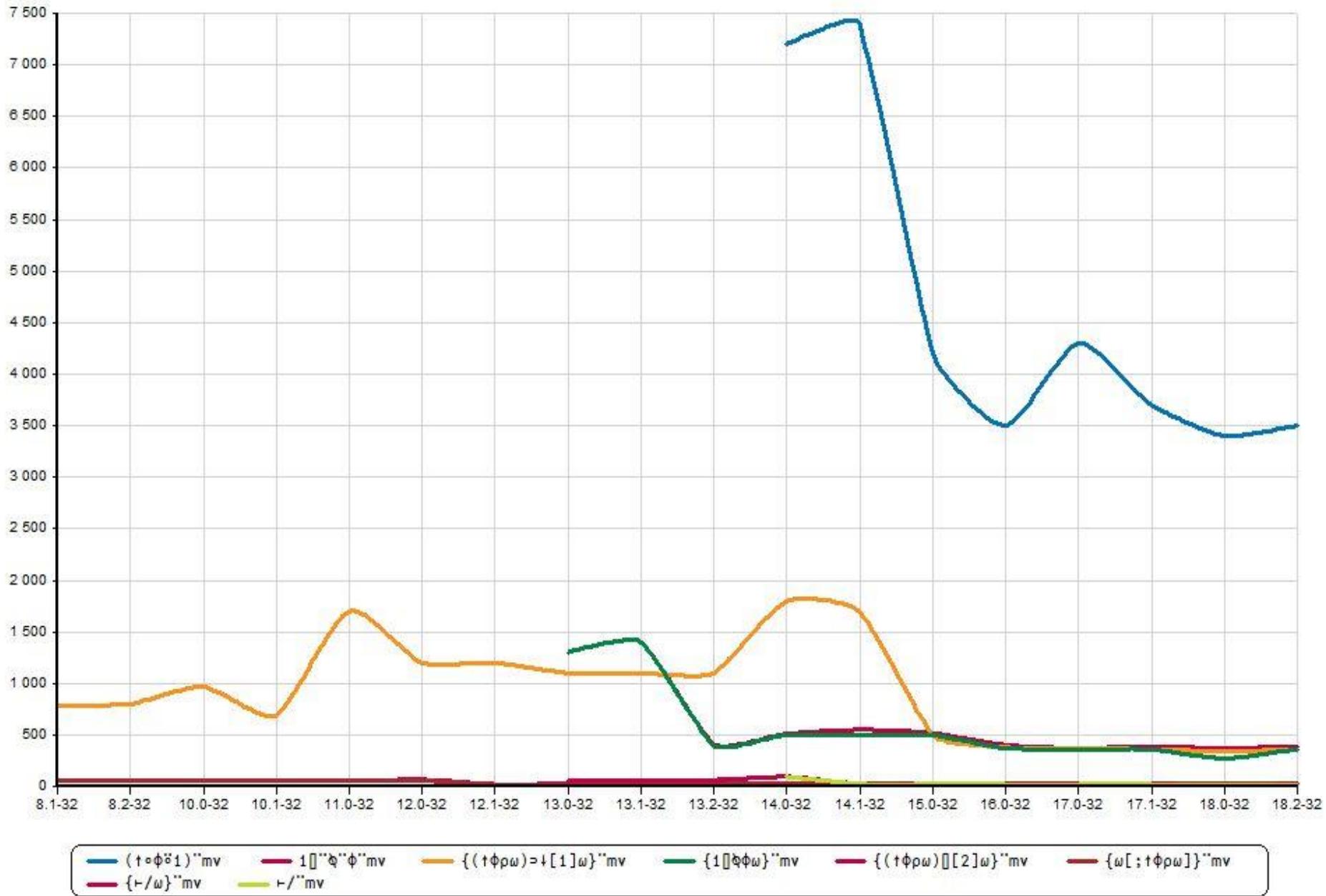
Are all binary vector values equal to 1?



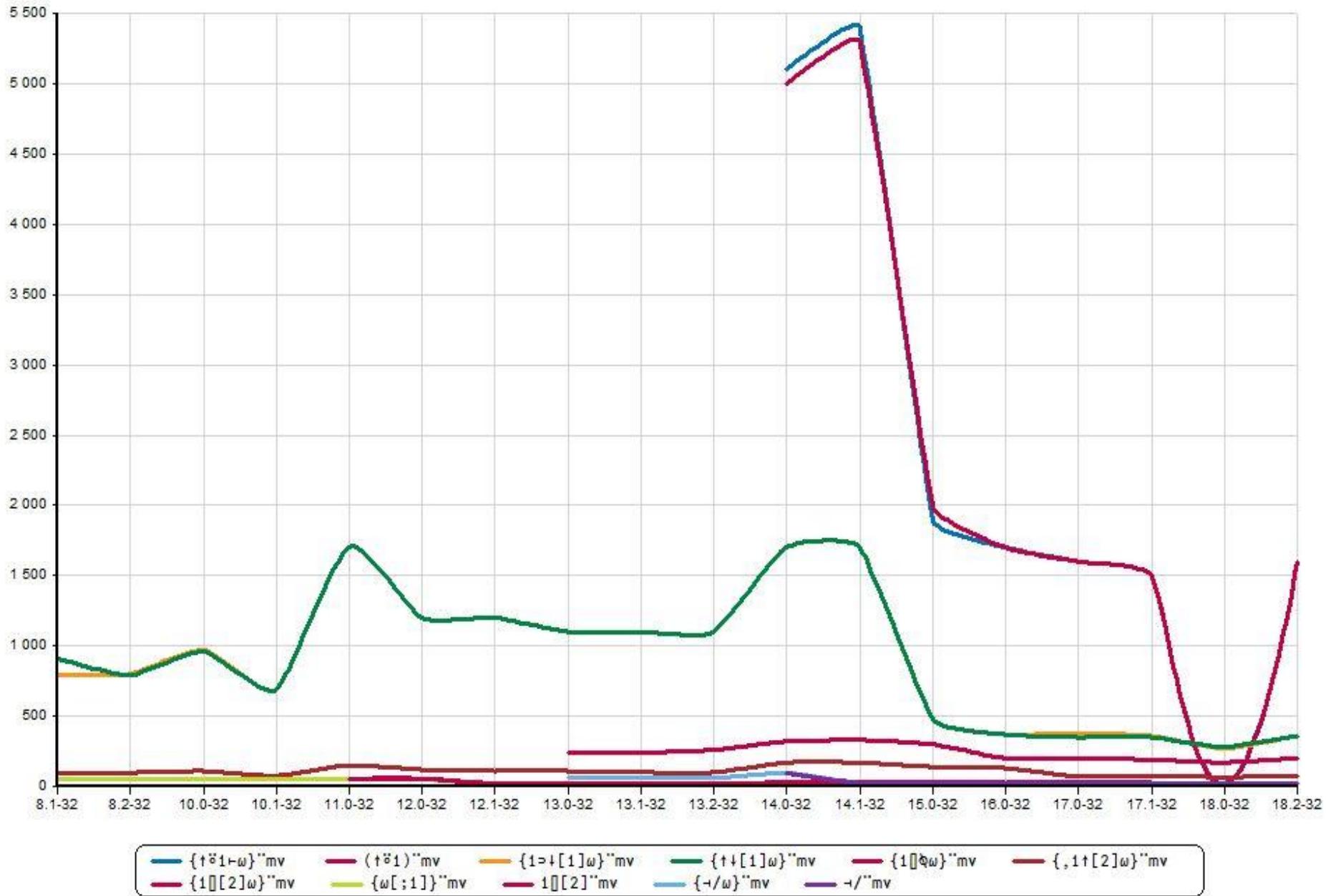
Text case change



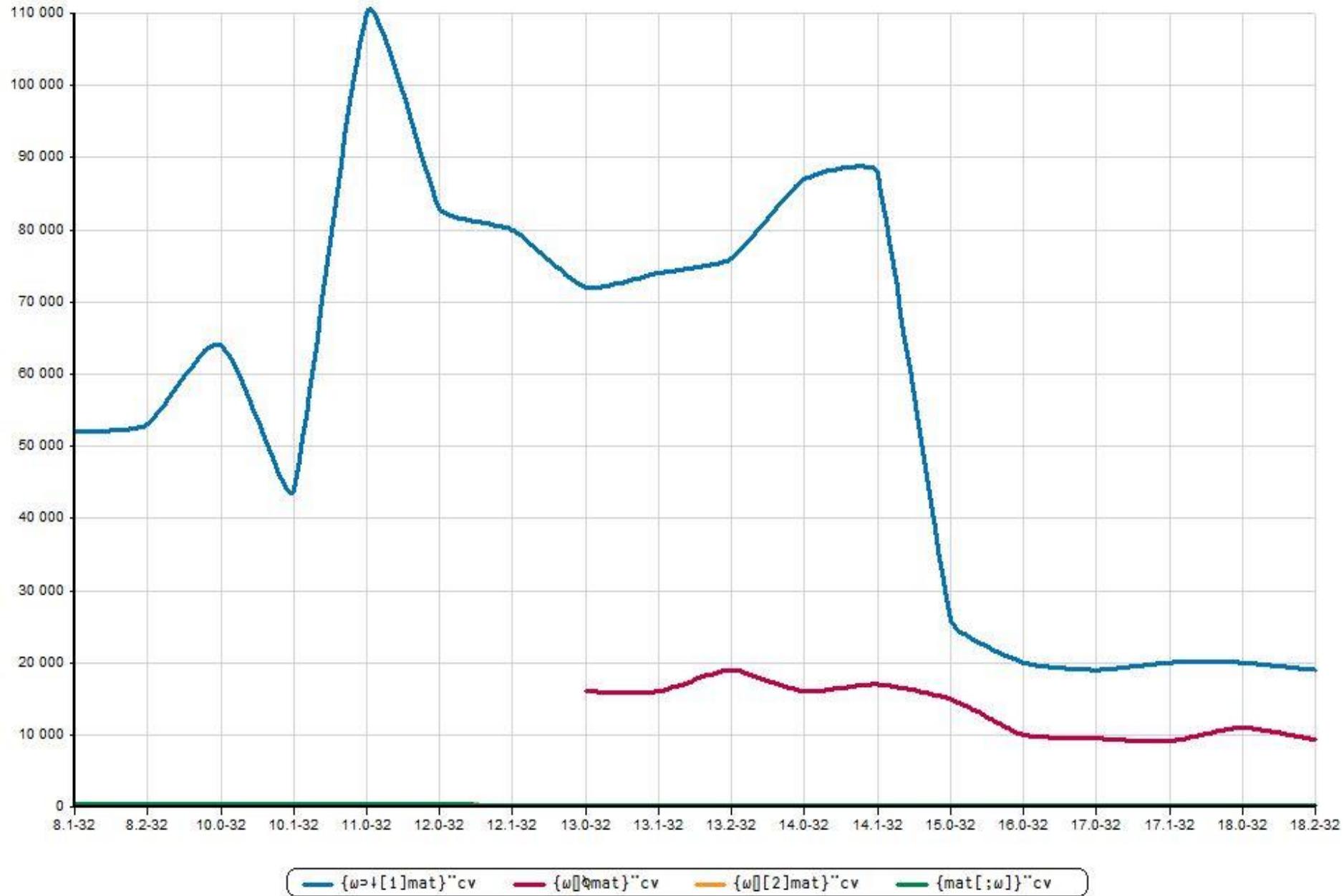
Last column of matrix



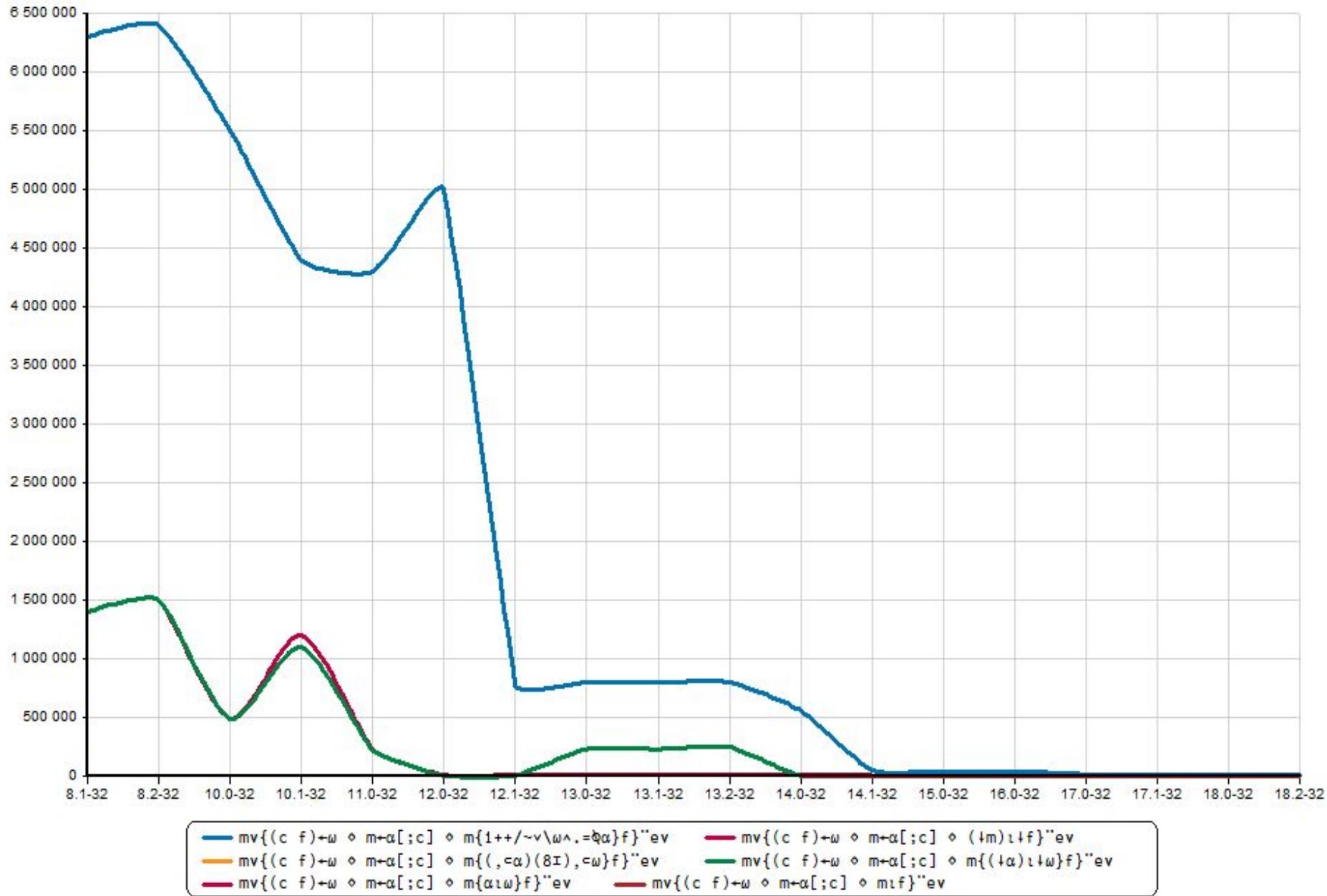
First column of matrix



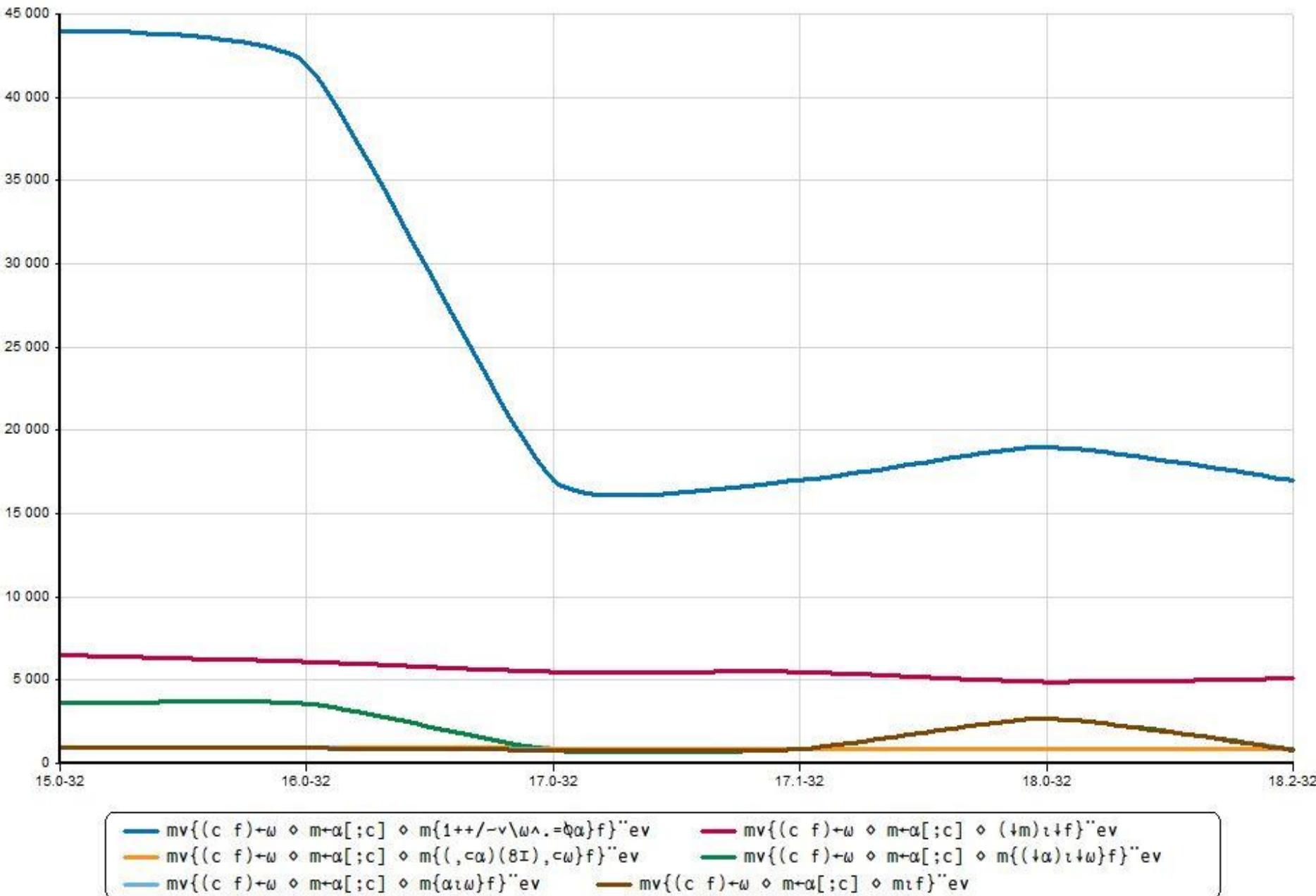
Pick a column from a matrix



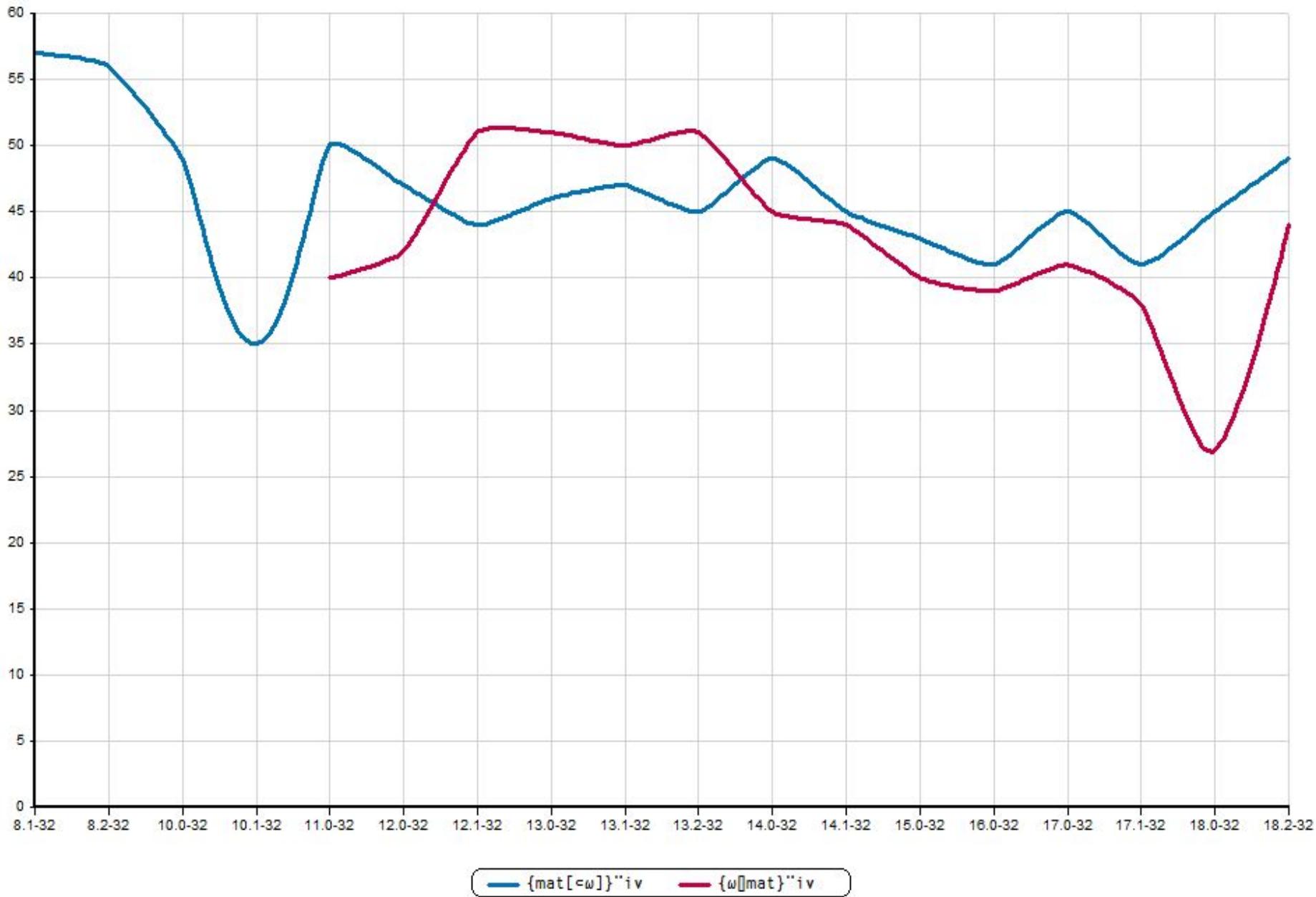
Search matrix rows ($\square CT=0$)



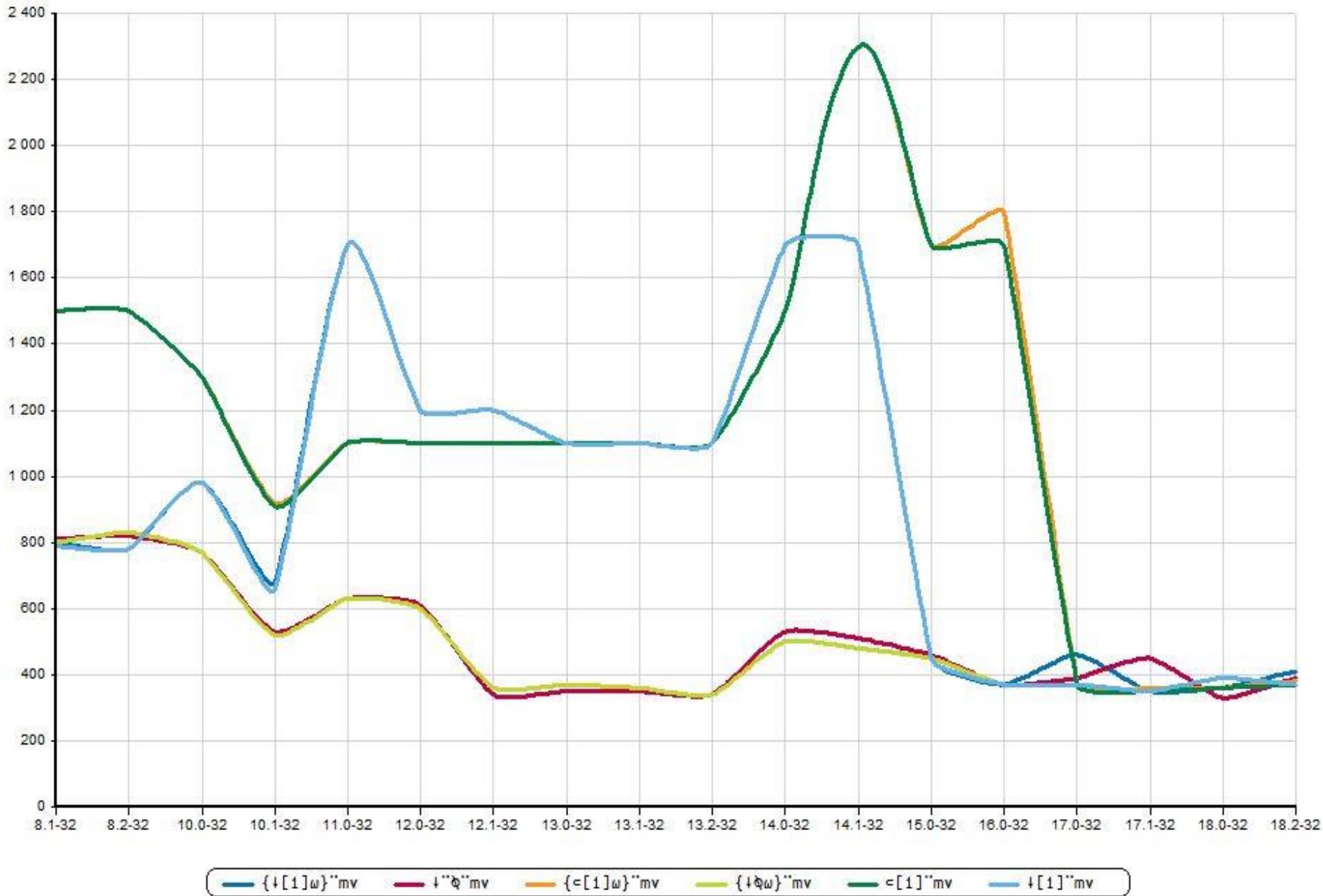
Search rows in a matrix ($\square CT=0$)



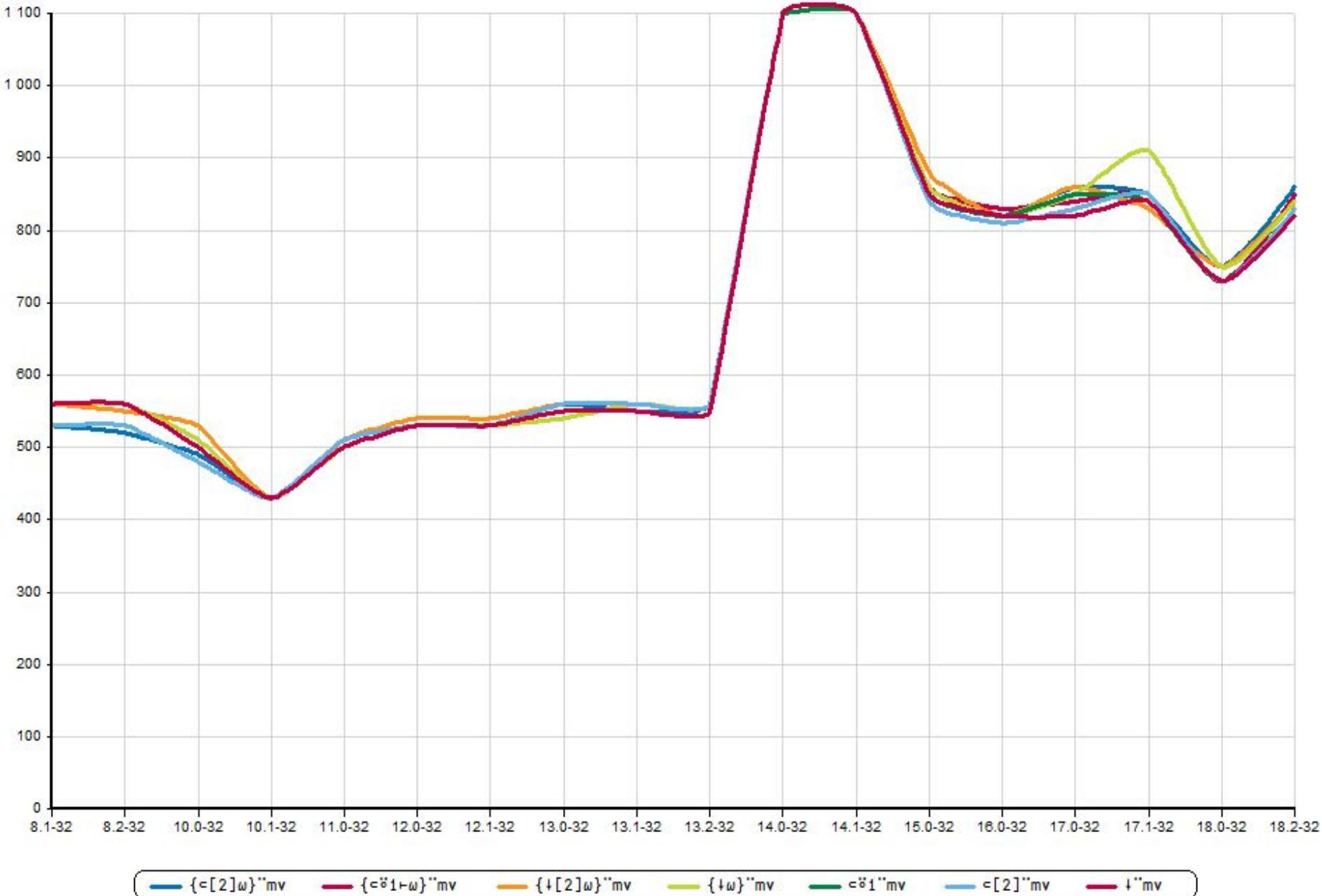
Pick multiple elements from matrix



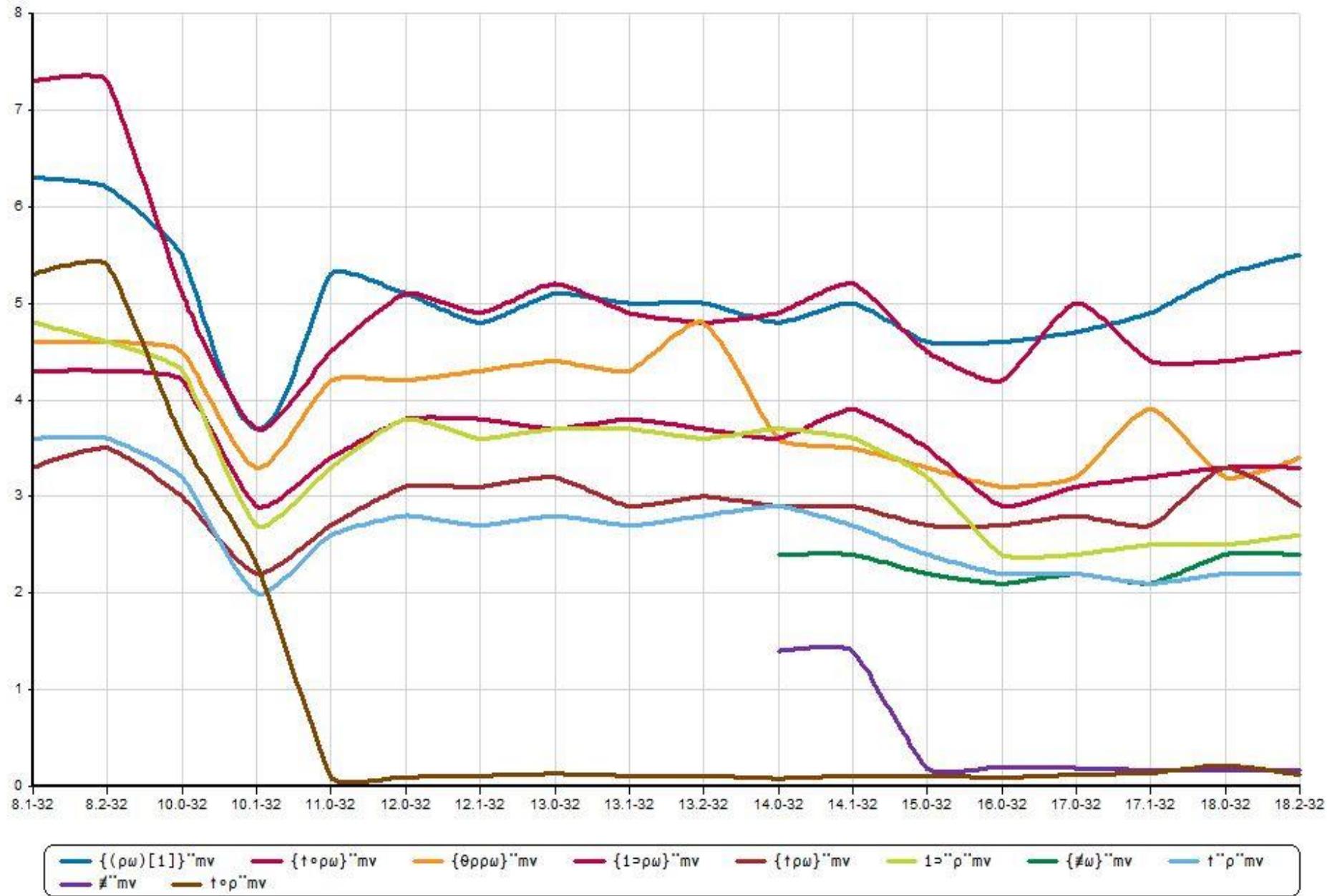
Matrix to a nested column vector



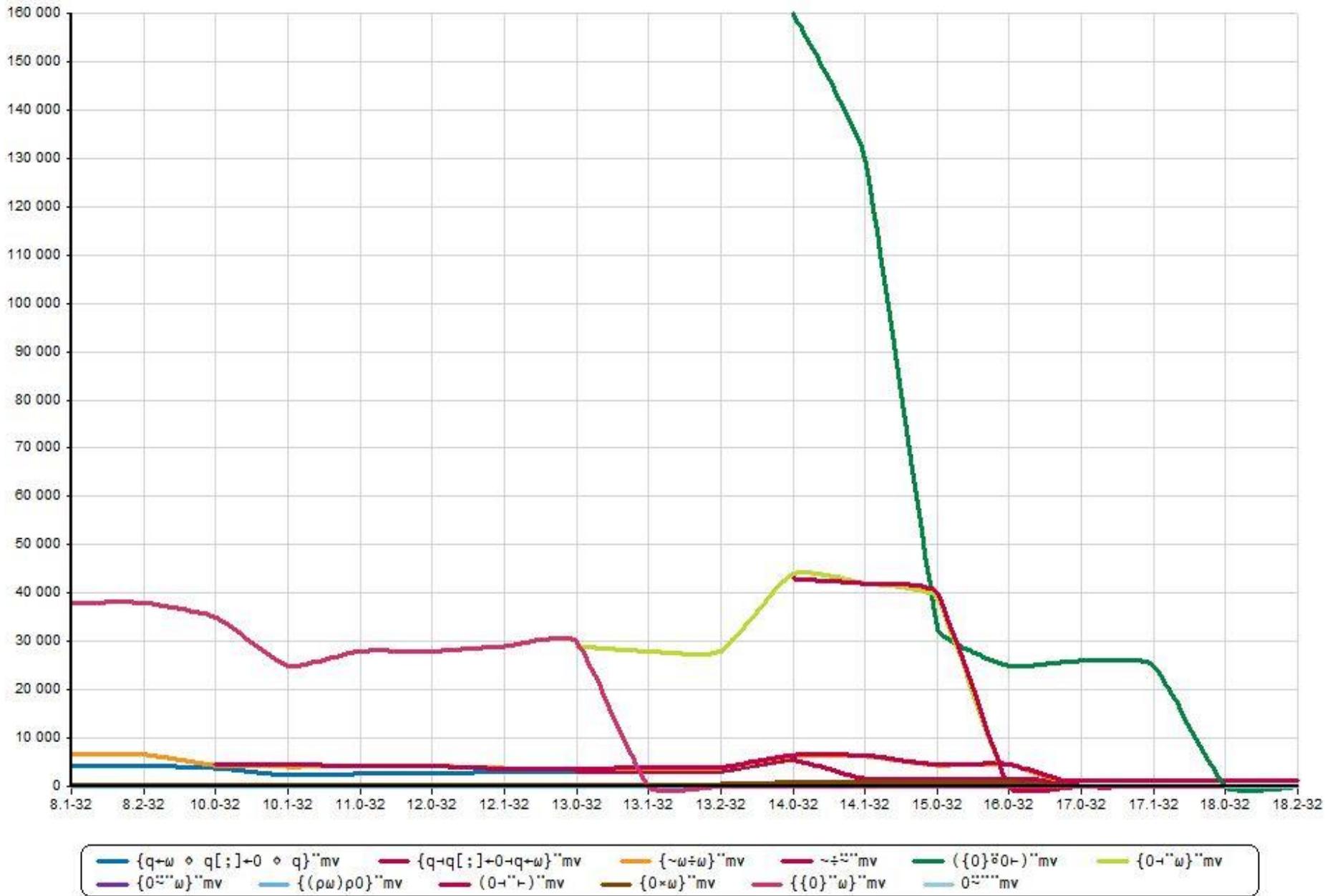
Matrix to a nested row vector



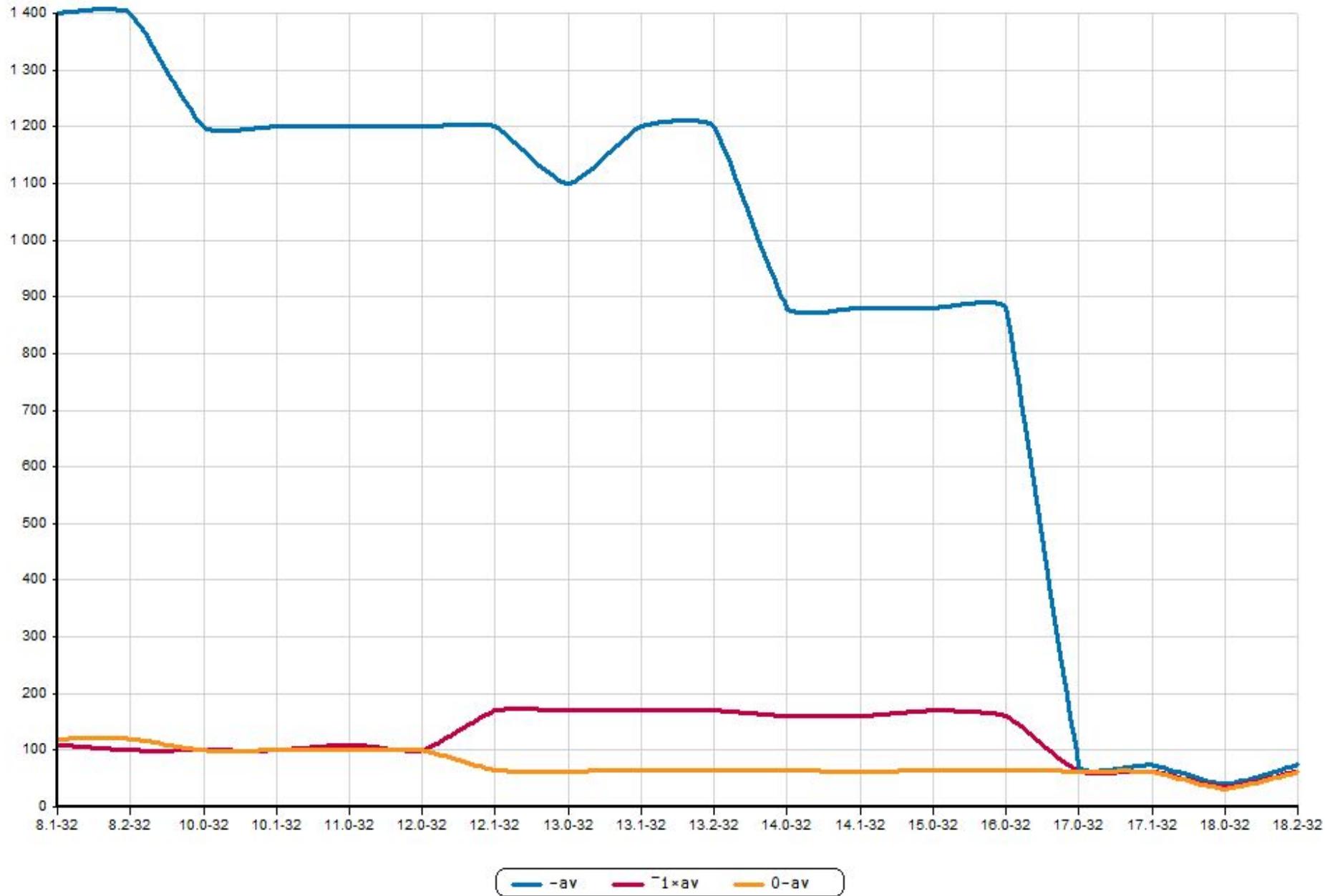
Number or matrix rows (as scalar)



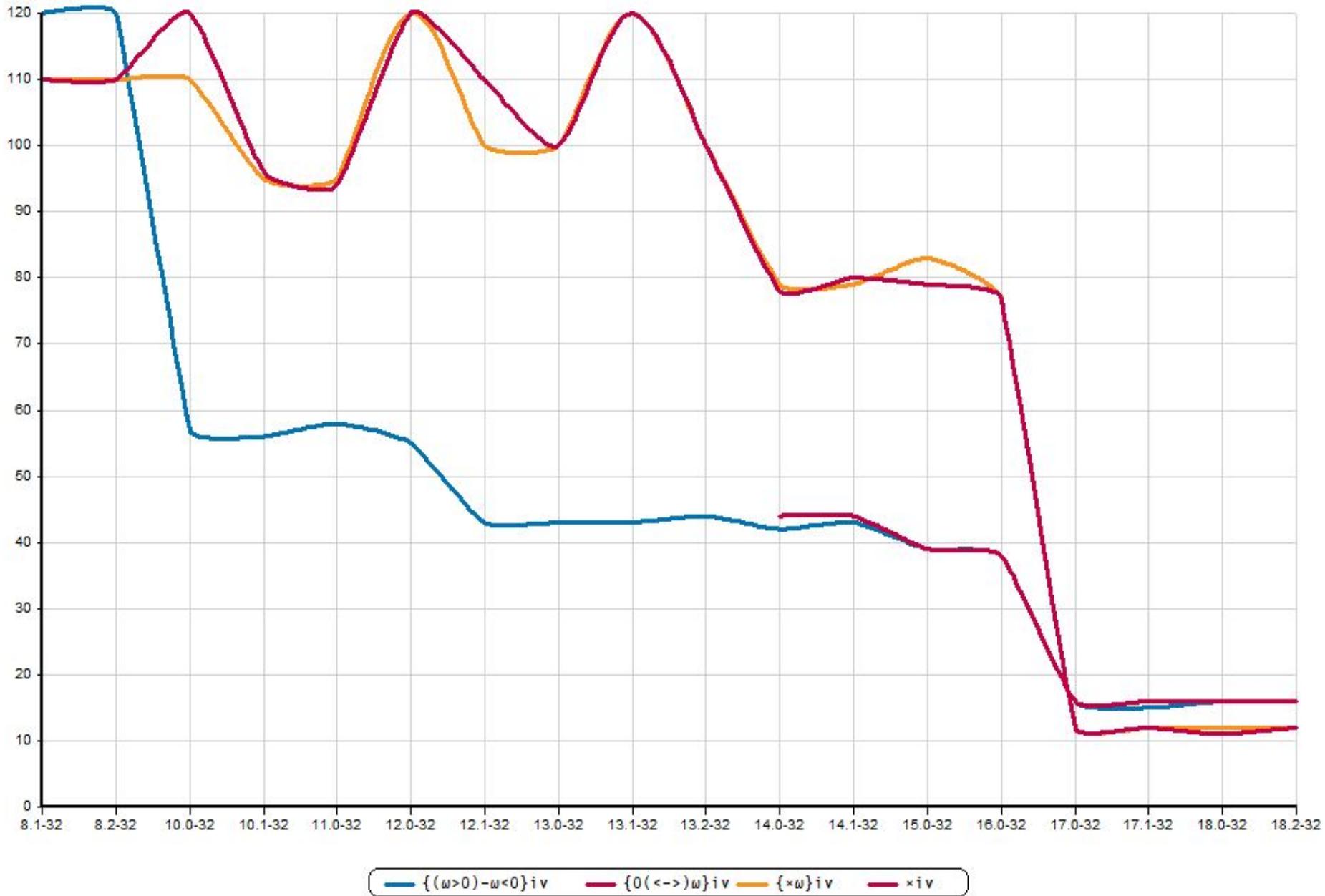
Zero matrix (same shape as the argument)



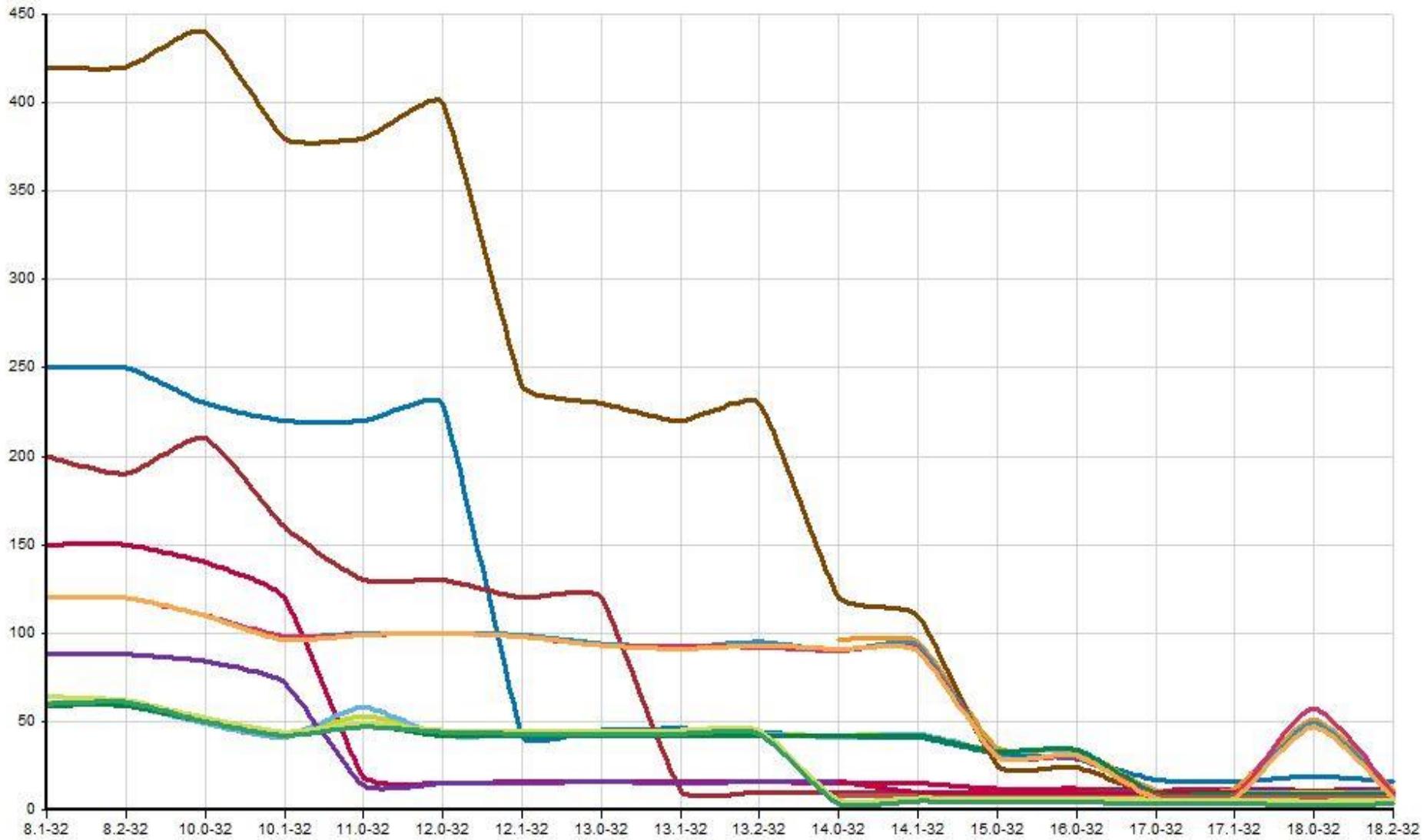
Negate of a numeric array



Signum of a numeric array

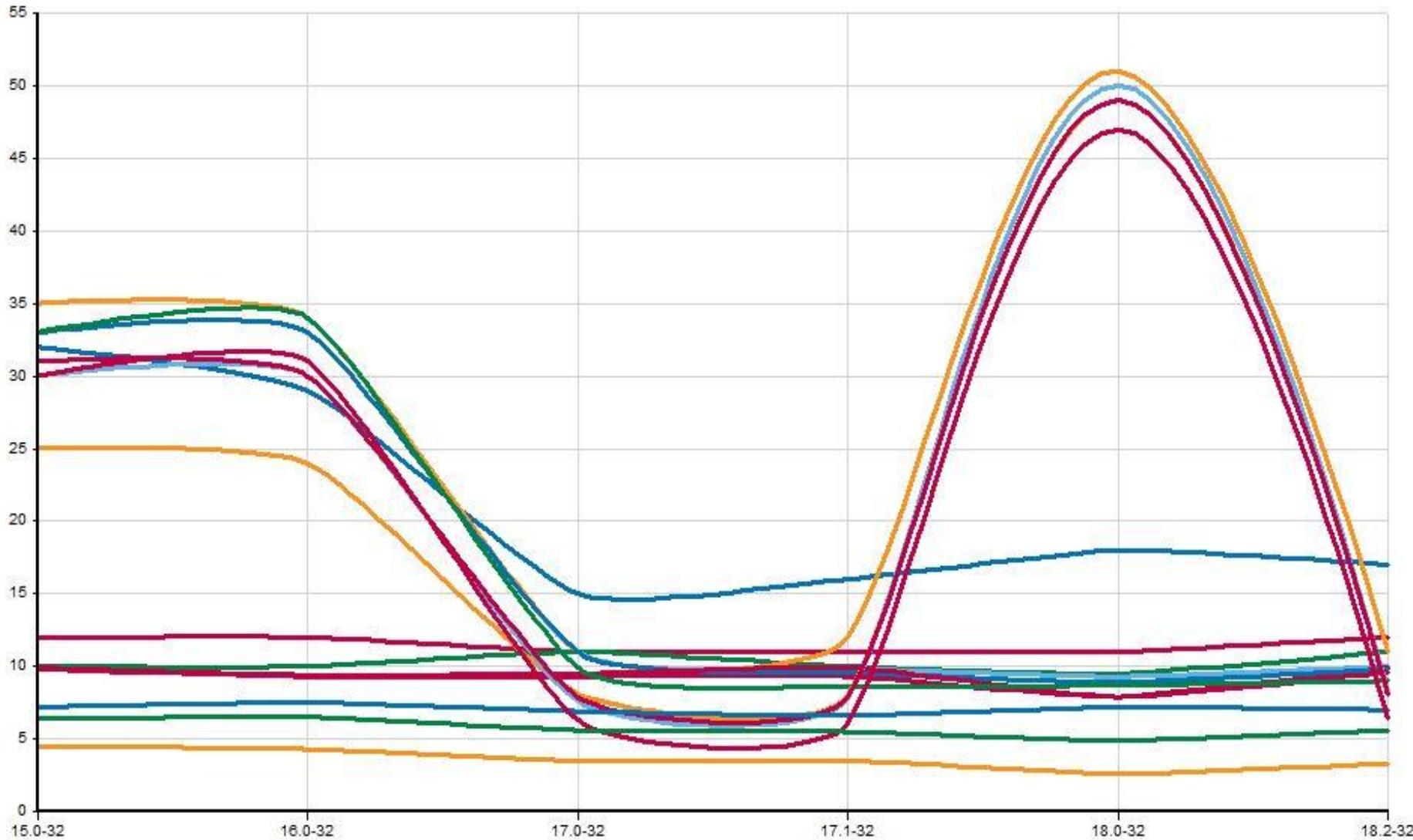


Does vector consist of spaces only?



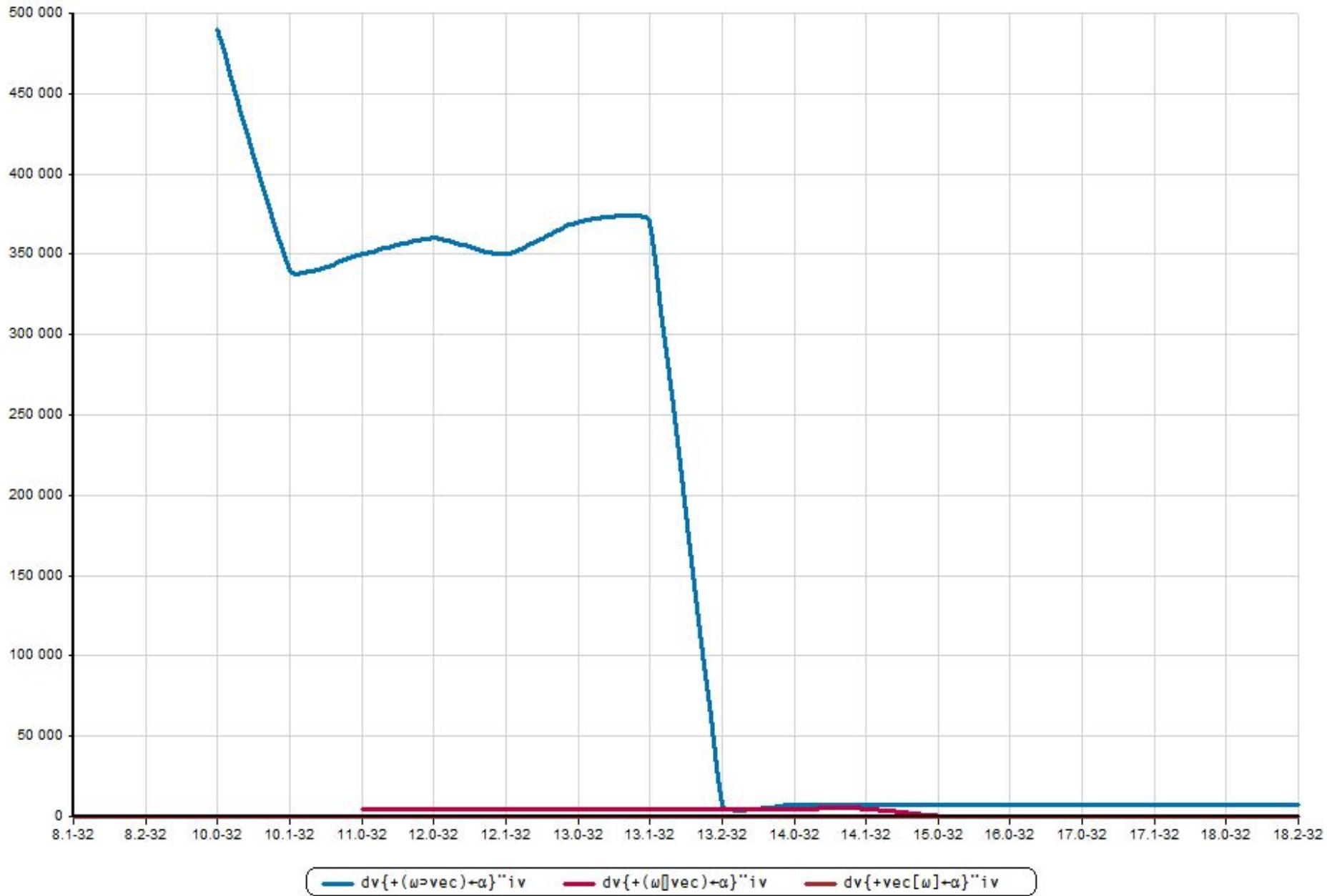
- | | | | | | | | | | |
|--------------------------------------|--|--|----------------------------------|--------------------------------------|-----------------------------------|------------------------------------|----------------------------|----------------------------------|--------------------------------------|
| $\{0 \epsilon \rho \omega' ' \}''vv$ | $\{(' ' = + \omega) \wedge \omega \equiv 1 \phi \omega\}''vv$ | $\{\omega \equiv (\rho \omega) / ' ' \}''vv$ | $(0 \epsilon ' ' = \omega)''vv$ | $\{\vee / ' ' \neq \omega\}''vv$ | | | | | |
| $\{\wedge / ' ' = \omega\}''vv$ | $\{\omega \equiv (\rho \omega) \rho' ' \}''vv$ | $\{\omega \equiv (\# \omega) \rho' ' \}''vv$ | $\{\times / ' ' = \omega\}''vv$ | $\{\omega \equiv \omega' ' \}''vv$ | $\{0 \epsilon ' ' = \omega\}''vv$ | $\{ ' ' (\wedge / =) \omega\}''vv$ | $0 \epsilon '' ' ' = ''vv$ | $\{ ' ' \wedge . = \omega\}''vv$ | $\{1 \epsilon ' ' \neq \omega\}''vv$ |
| $\{0 \epsilon ' ' = \omega\}''vv$ | $\{ ' ' (\wedge / =) \omega\}''vv$ | $0 \epsilon '' ' ' = ''vv$ | $\{ ' ' \wedge . = \omega\}''vv$ | $\{1 \epsilon ' ' \neq \omega\}''vv$ | | | | | |

Does vector consist of spaces only?

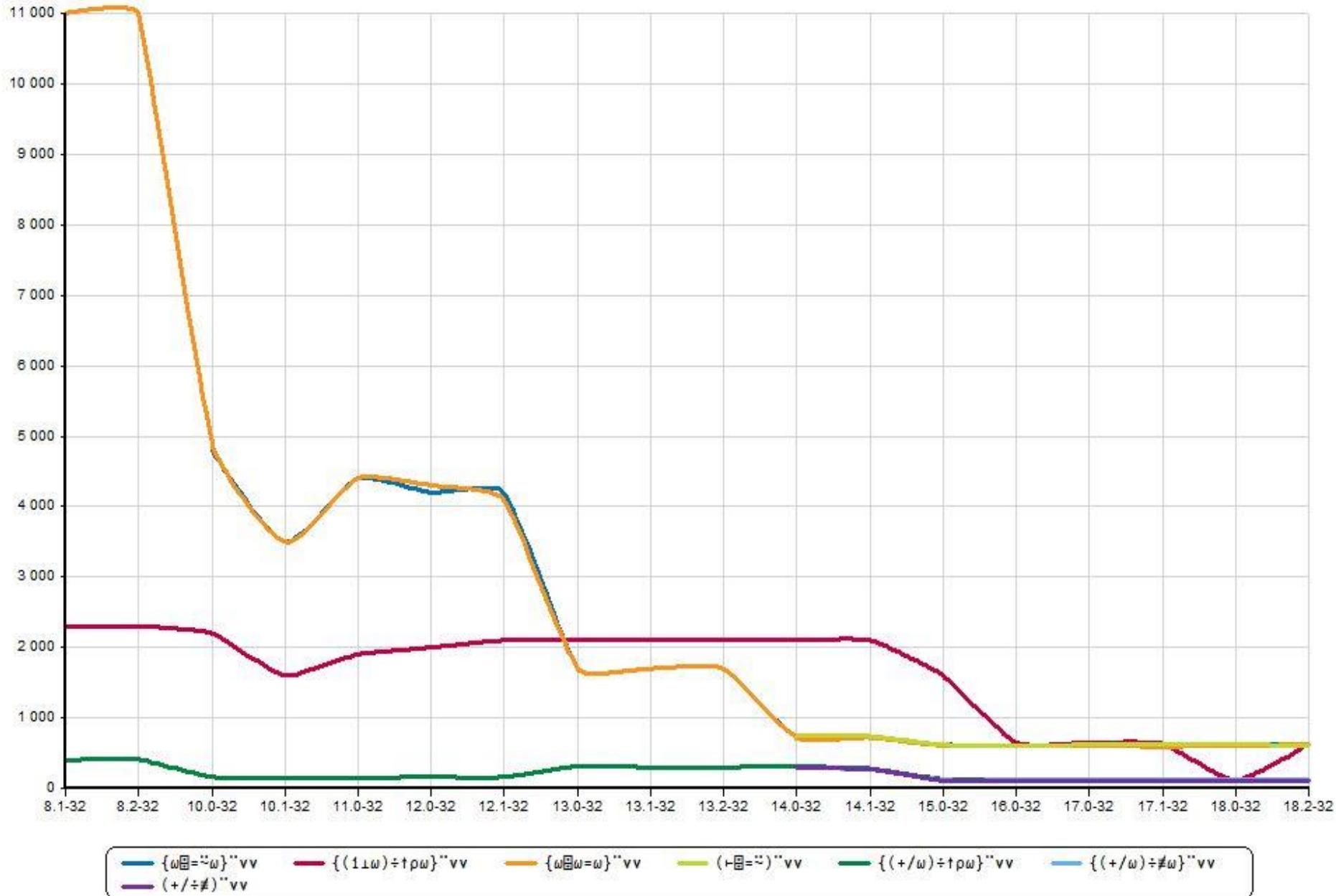


$\{0 \in \rho \omega -' \neq \omega\}''vv$	$\{(' = \tau \omega) \wedge \omega = 1 \phi \omega\}''vv$	$\{\omega = (\rho \omega) / ' \neq \omega\}''vv$	$\{(-0 \epsilon ' \neq \omega) \wedge \omega\}''vv$
$\{-\vee / ' \neq \omega\}''vv$	$\{\omega = (\rho \omega) \rho ' \neq \omega\}''vv$	$\{\wedge / ' \neq \omega\}''vv$	$\{\omega = (\# \omega) \rho ' \neq \omega\}''vv$
$\{(-0 \epsilon \omega \epsilon ' \neq \omega)\}''vv$	$\{(-0 \epsilon ' \neq \omega) \wedge \omega\}''vv$	$\{-1 \epsilon ' \neq \omega\}''vv$	$\{\times / ' \neq \omega\}''vv$
$\{(' \wedge . = \omega)\}''vv$	$\{ ' \wedge . = \omega\}''vv$	$\{(' (\wedge / =) \omega)\}''vv$	$\{-0 \epsilon '' \neq ''vv\}$

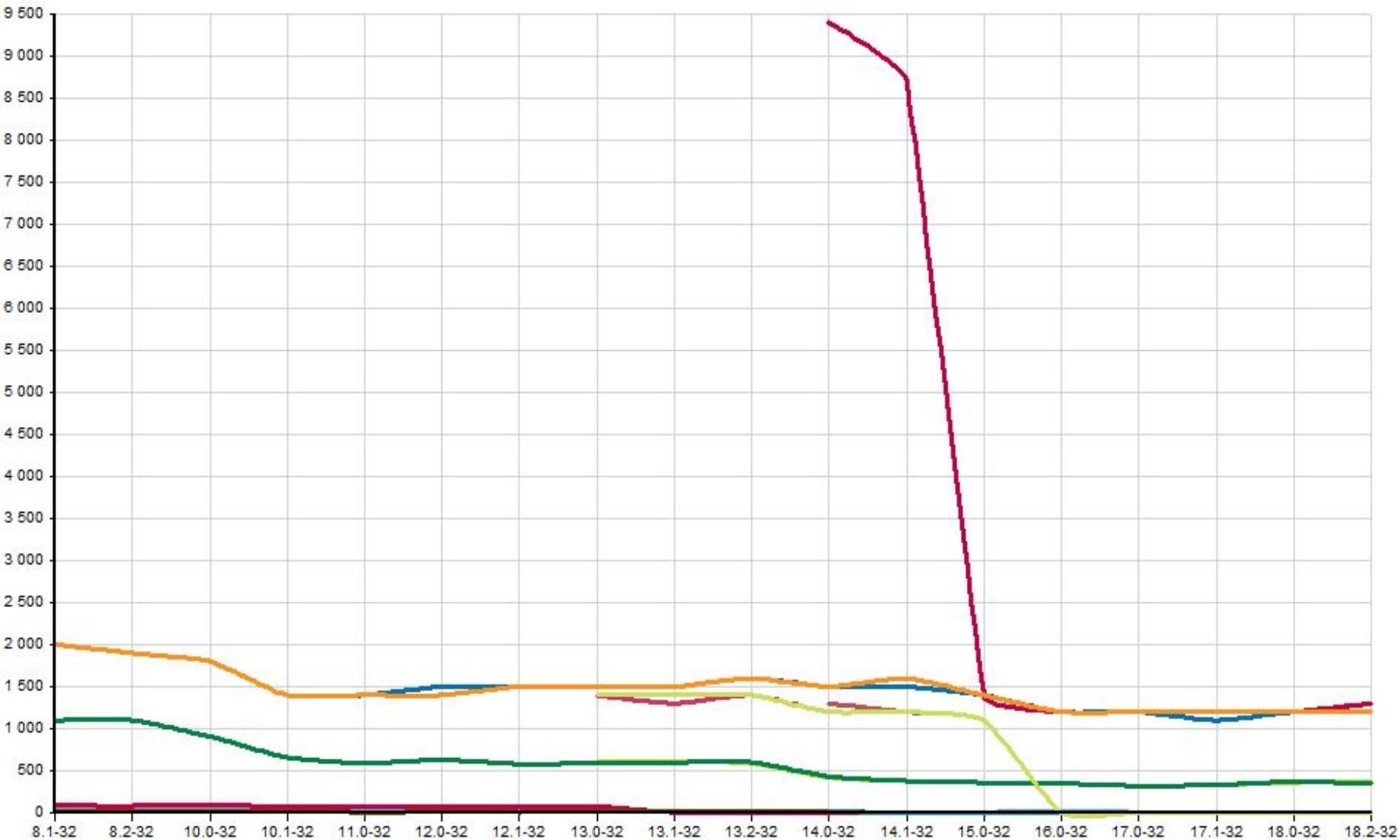
Assign vector element



Mean of a numeric vector

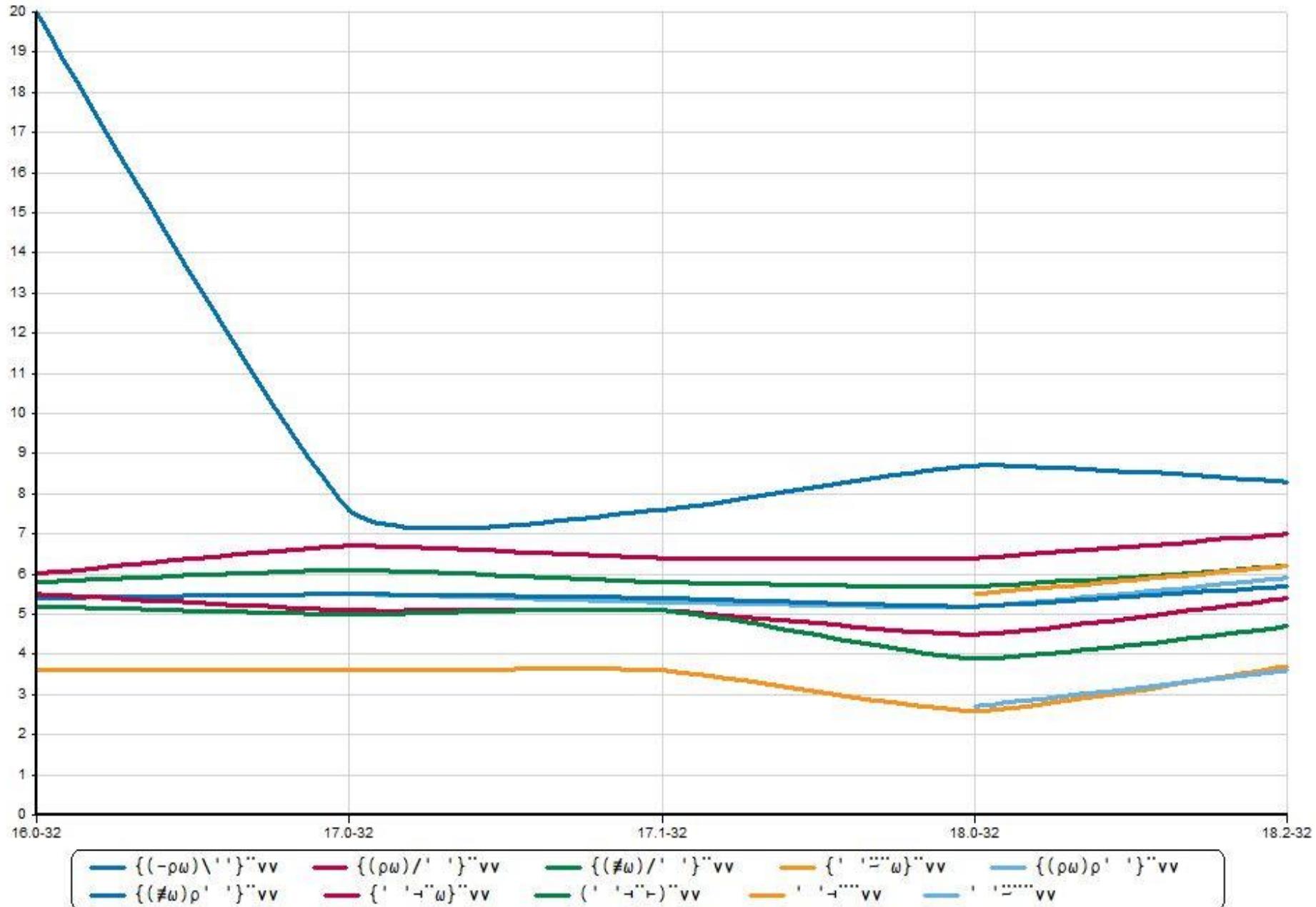


Vector of spaces (same shape as the argument)



$\{\{ \cdot \}''\omega\}'''vv$	$\{(\rho\omega)/' '\}'''vv$	$\{q-\omega \diamond q[] + ' ' \diamond q\}'''vv$
$\{(-\rho\omega)\backslash ''\}'''vv$	$\{(\# \omega)/' '\}'''vv$	$\{(\# \omega)\rho' '}\}'''vv$
$\{\cdot ' -''\omega\}'''vv$	$\{(\# \omega)\rho' '}\}'''vv$	$\{(\# \omega)\rho' '}\}'''vv$

Vector of spaces (same shape as argument)

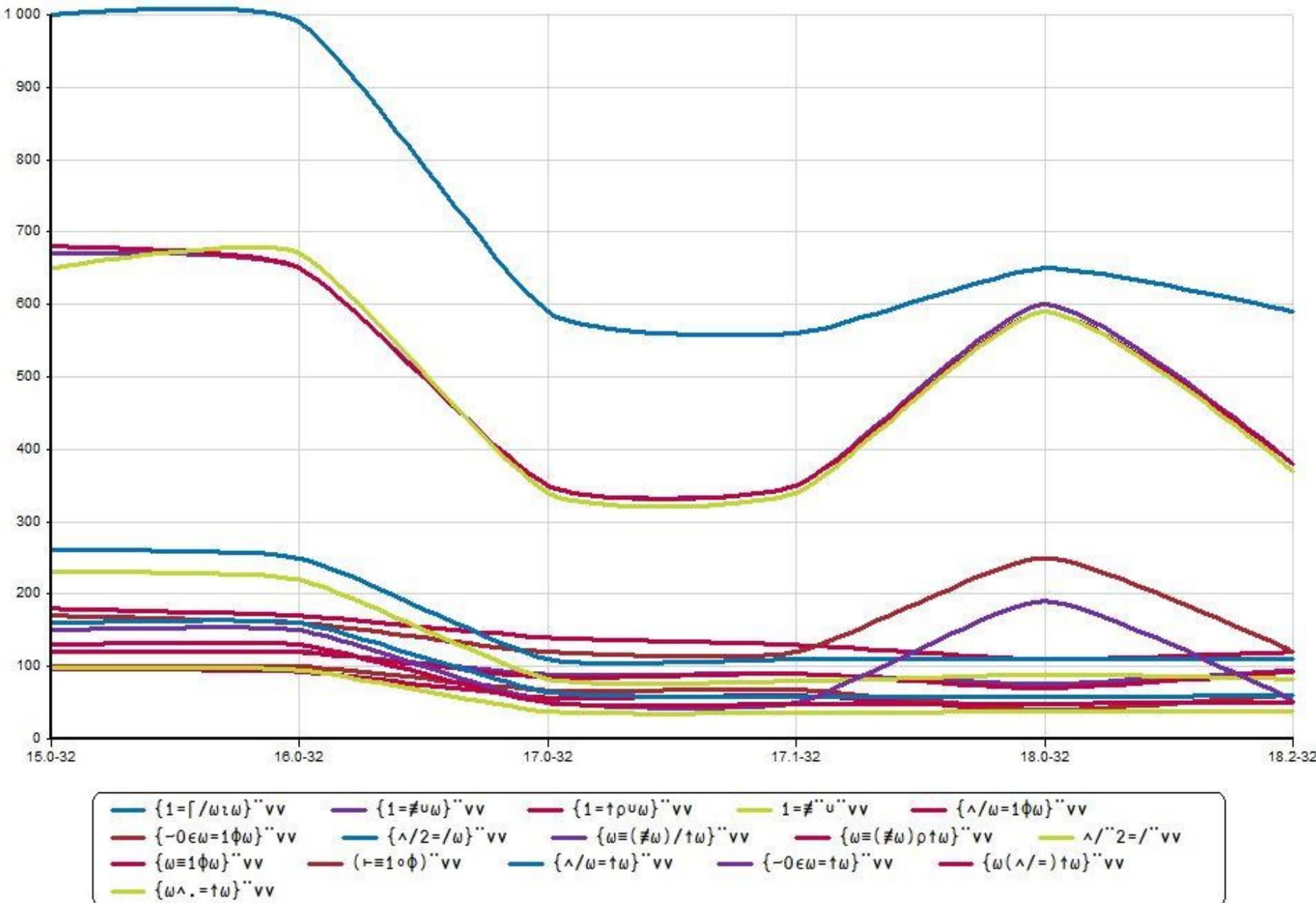


Are all vector items equal?

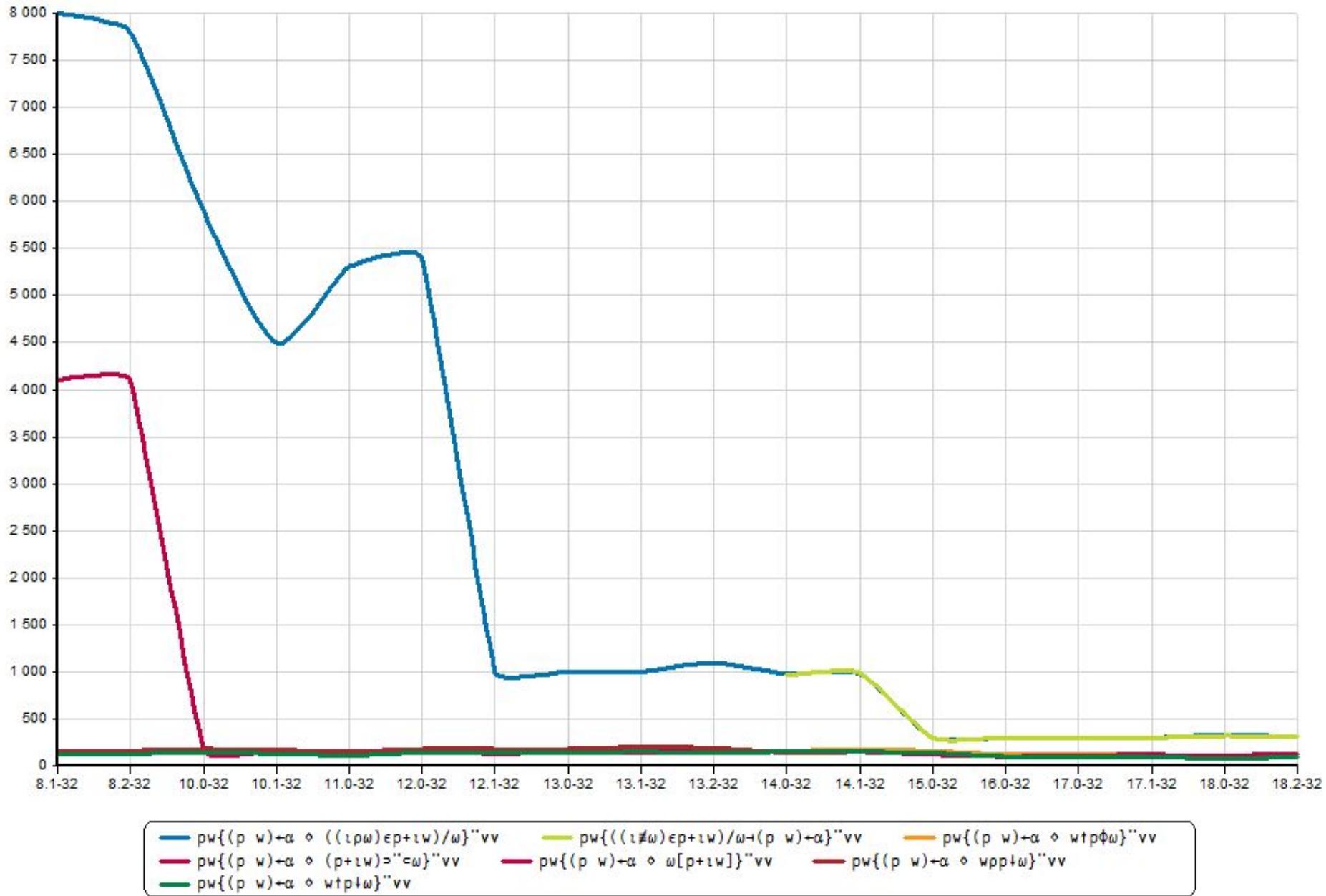


- {1=Γ/ωιω}''vv — {1=†ρυω}''vv — {1=♯υω}''vv — 1=♯''υ''vv — {^/ω=1Φω}''vv — {0εω=1Φω}''vv
- {^/2=/ω}''vv — {ω≡(♯ω)/†ω}''vv — {ω≡(♯ω)ρ†ω}''vv — ^/''2=/''vv — {^/ω=†ω}''vv — (†=1◦Φ)''vv
- {ω≡1Φω}''vv — {0εω=†ω}''vv — {ω(^/=)†ω}''vv — {ω^.=†ω}''vv

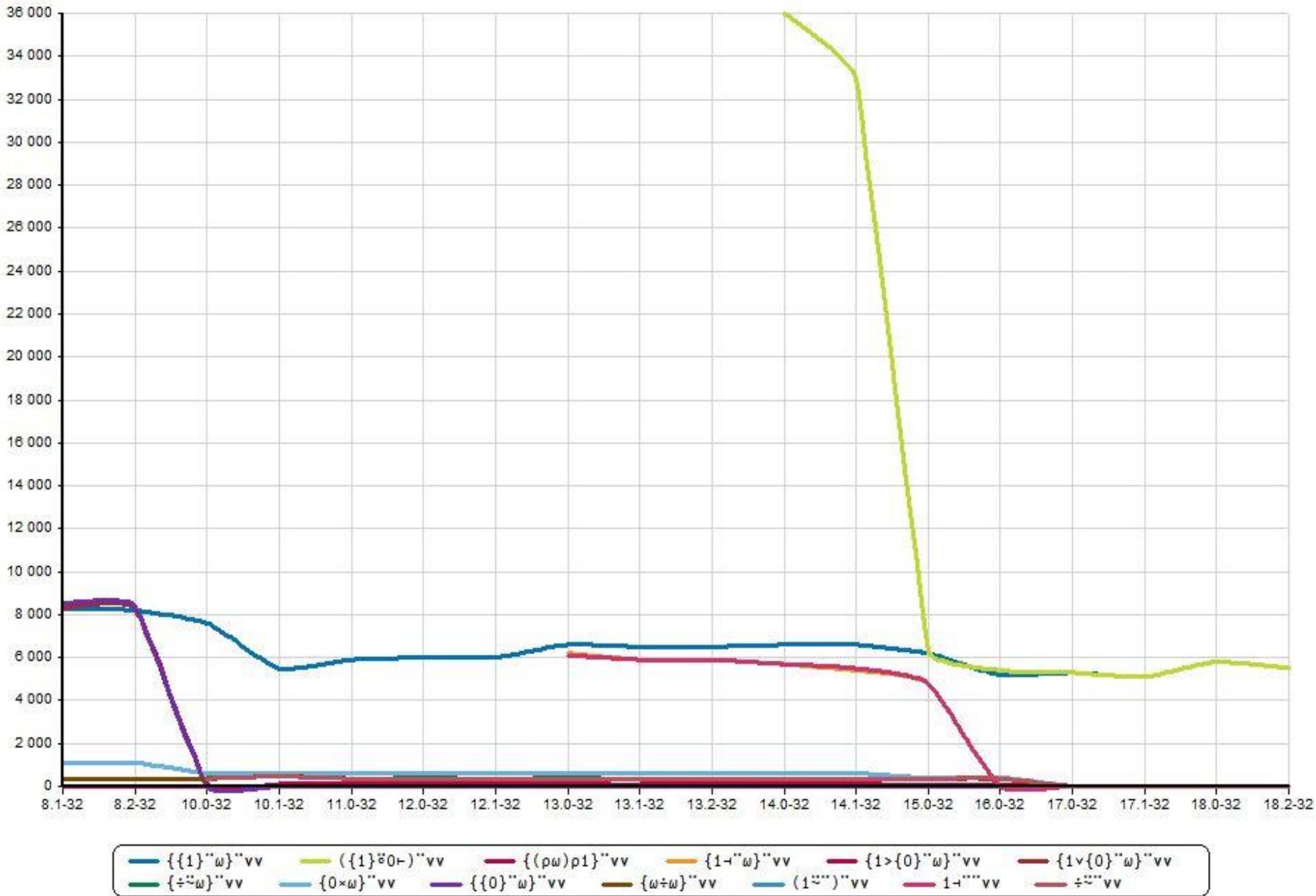
Are all vector items equal?



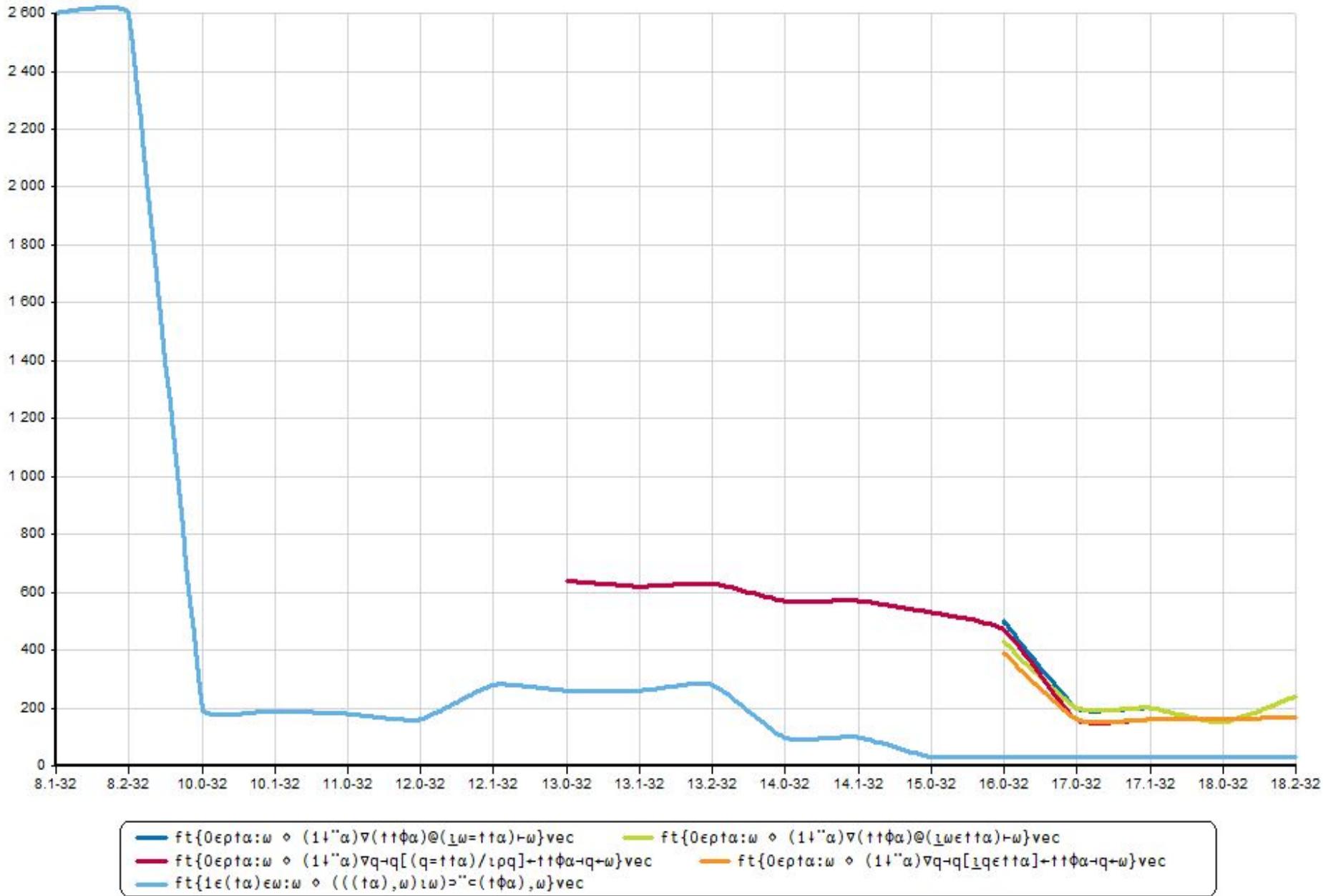
Pick a block from vector



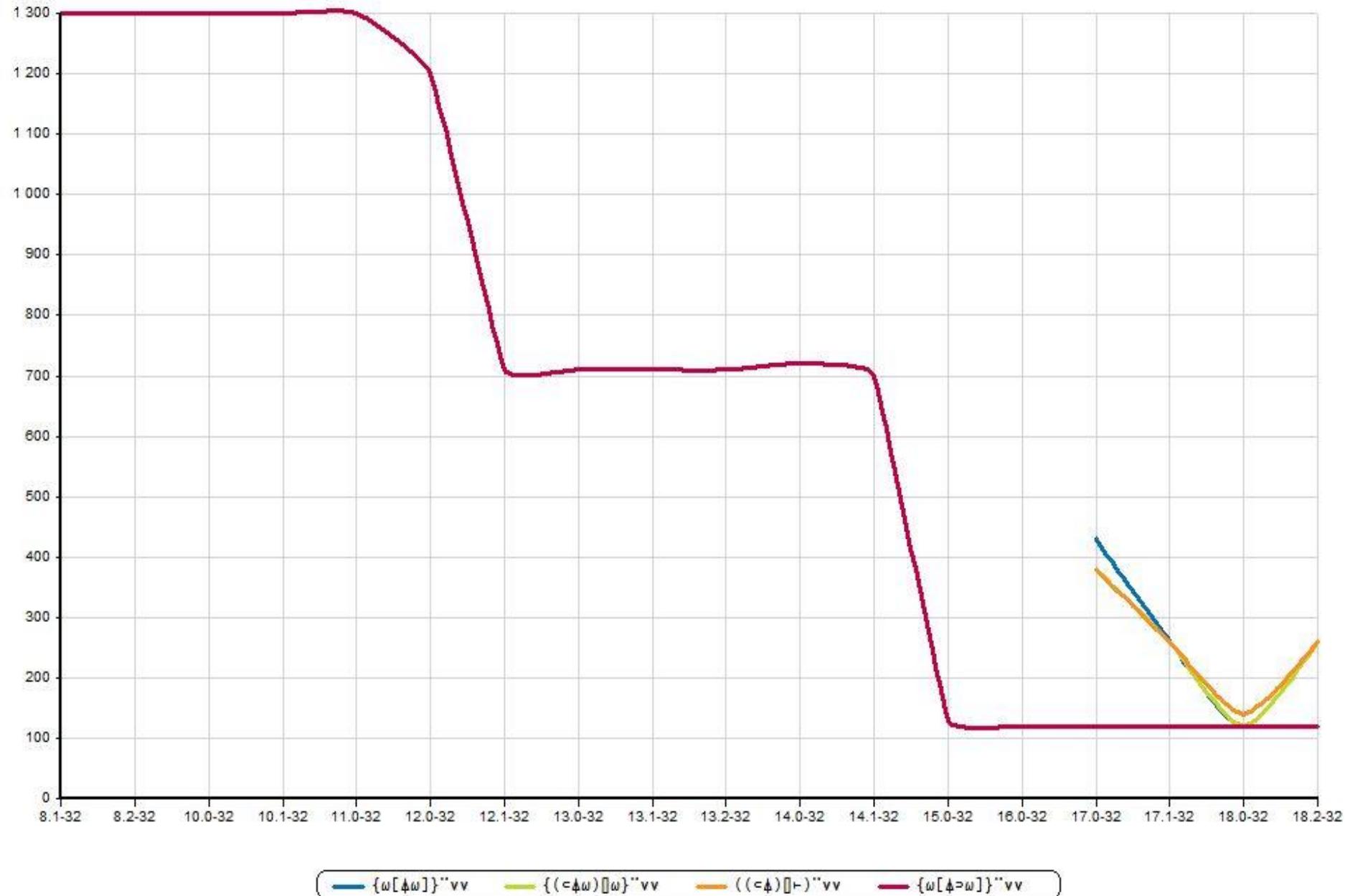
Vector of ones (same shape as the argument)



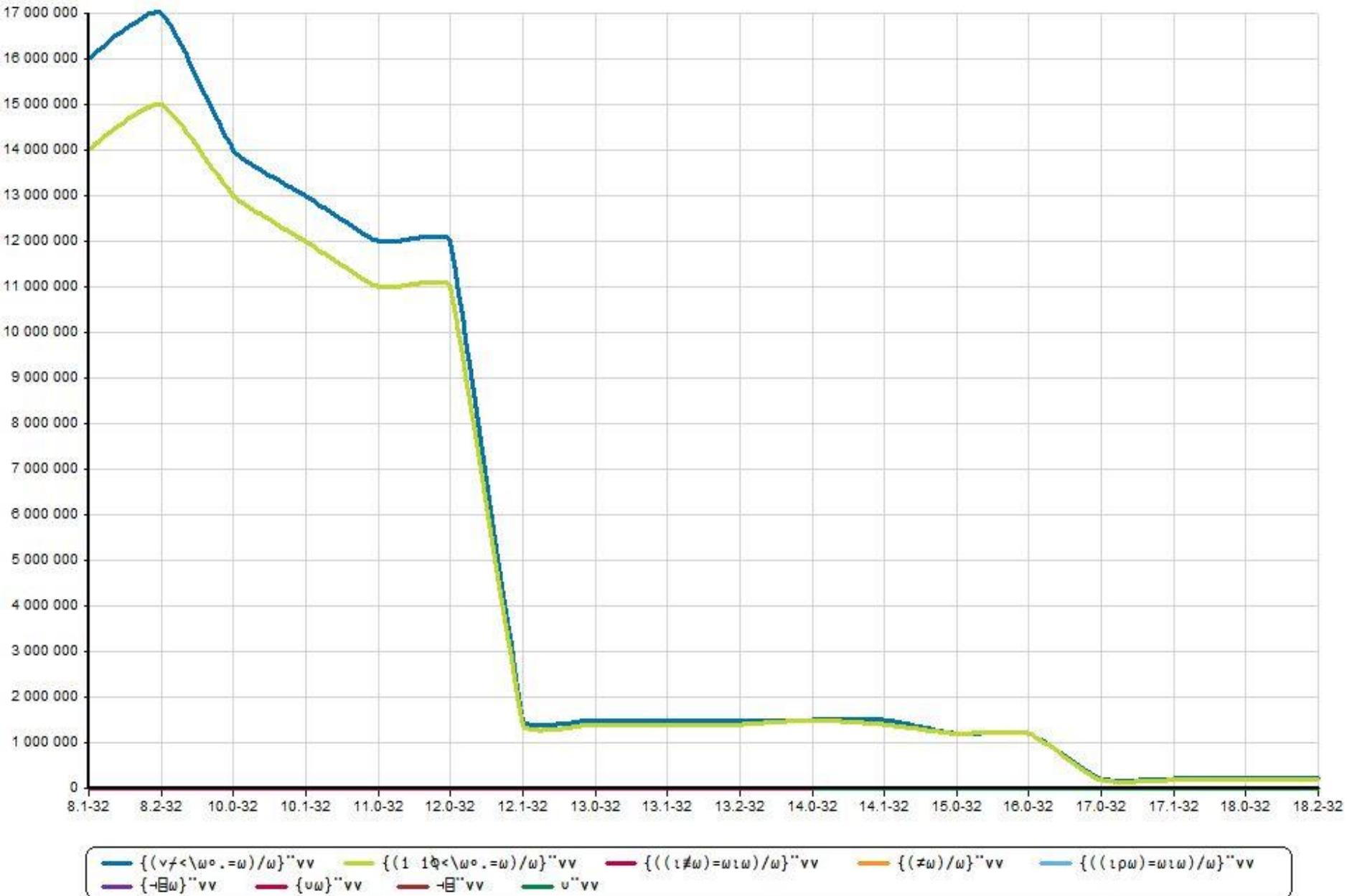
Replace vector characters (plenty)



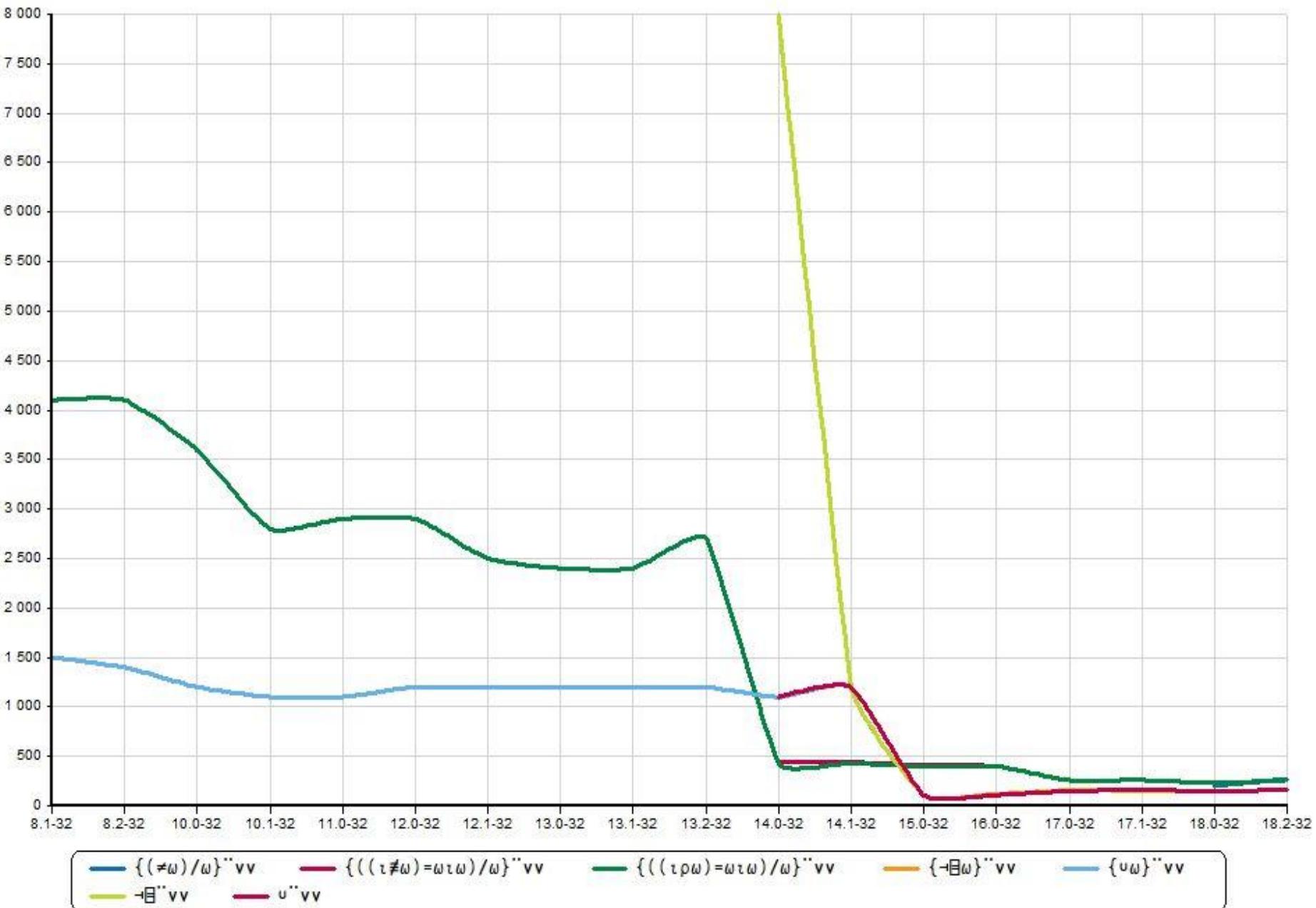
Vector sort



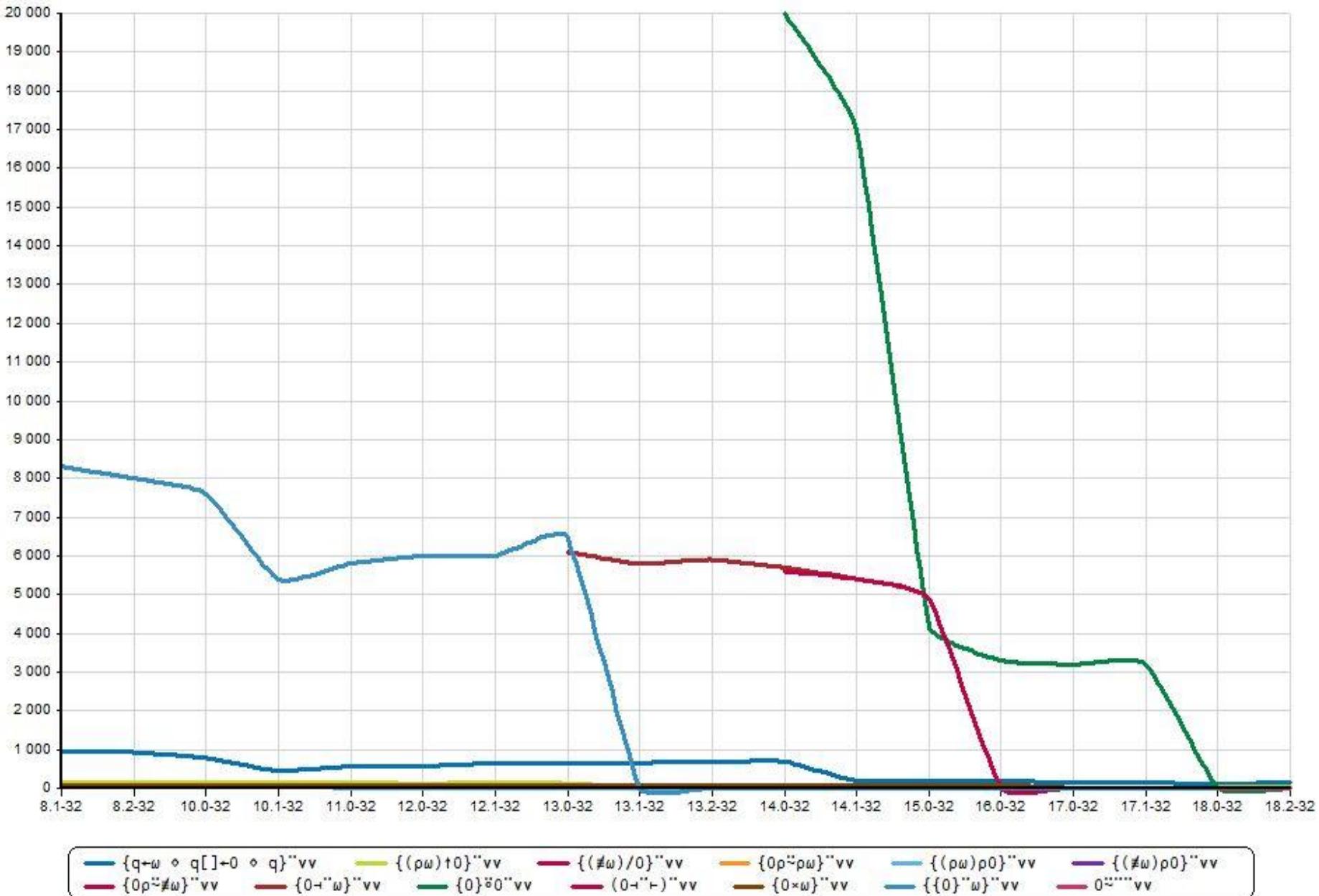
Unique vector items



Unique items of a vector



Zero vector (same shape as the argument)



Workspace available

